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ABSTRACT

This document suggests a systematic approach to the development of appropriate applied basic skills instructional materials. It is part of BASICS, a set of integrated materials developed to assist teachers, counselors, and administrators in bridging vocational and academic skills. Section 1 discusses the prerequisites to development of materials. The series of steps includes conduct needs assessment; determine job; conduct job analysis; identify tasks for instruction; conduct task analysis; cross-correlate occupational tasks with academic skills needed; determine type of instructional system; determine need to develop, adapt, update, or supplement materials; and specify the development task. Three types of curriculum material are presented as options for development from the preparatory work: competency-based individualized instruction, applied learning in a problem-solving mode, and lesson plans for traditional instruction. The three succeeding sections describe the characteristics of each type of material, the rationale for use, and guidelines for development. A sample of each type of curriculum is included. Management of the development process is discussed with reference to monitoring progress and controlling for quality. Appendixes include a checklist for evaluating materials for sex equity, an introduction to the structure of a competency-based module, a competency-based module incorporating basic skills, a student activity in a problem-solving mode, and a quality control checklist. (YLB)

Basics
Bridging Vocational and Academic Skills

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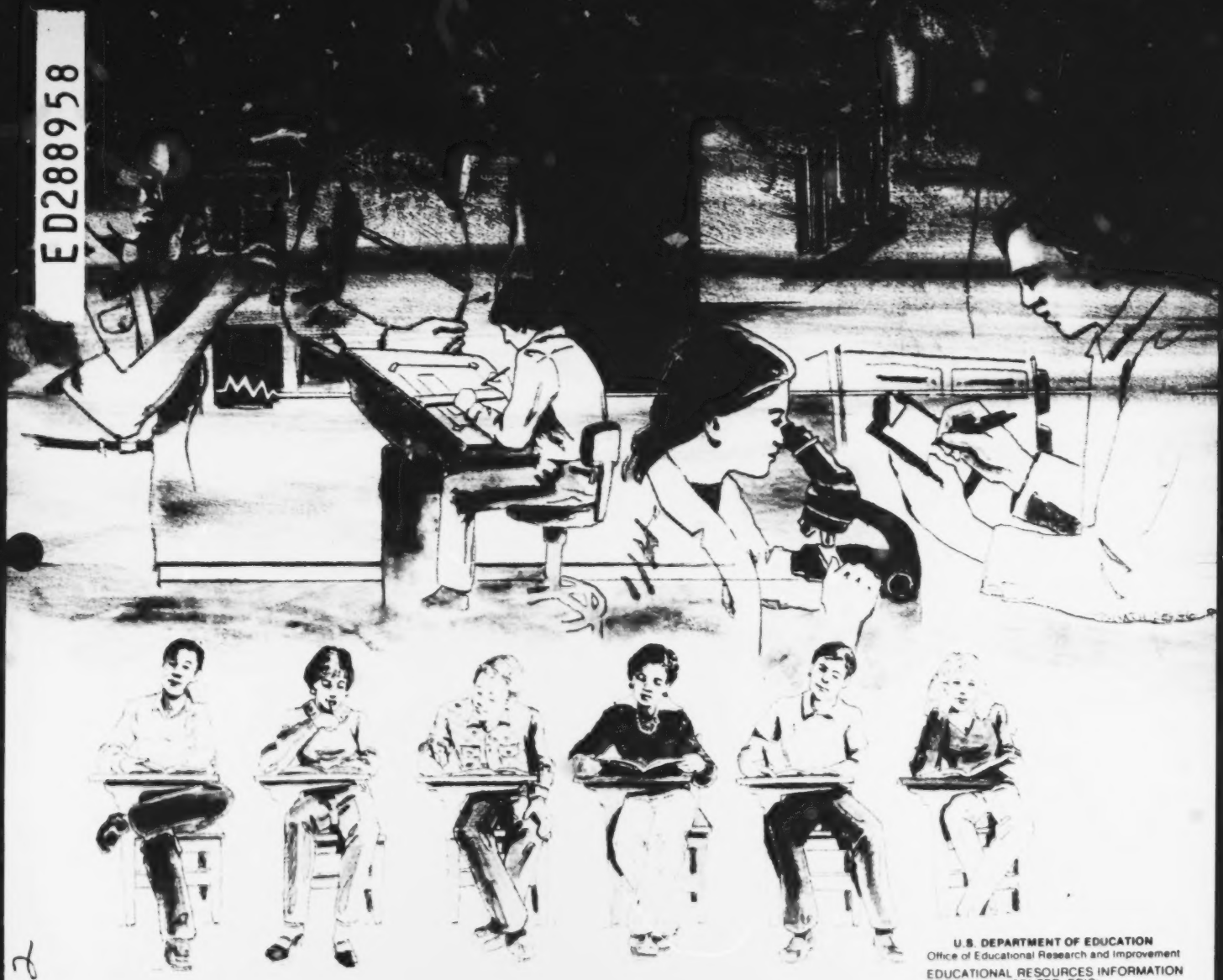

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INSTRUCTIONAL MATERIALS DEVELOPMENT

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Observation: **The development of systems analysis and needs assessment techniques, coupled with the technical sophistication of industrial training methods of the last quarter-century, provides a climate in vocational education especially conducive to the adoption of a similar approach to the teaching of basic skills.**

Dunn 1982, p. 2

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FOREWORD

Converging factors point to a need to look for new pathways to vocational education excellence: the public's increased expectations regarding academic outcomes of education, heightened by a number of national reports; increased graduation requirements and declining vocational enrollments in many states; the emphasis in the Perkins Act on the need for strengthening academic foundations; and business and industry requests that entry-level employees have a more thorough knowledge of the basic academics they will need to apply in their vocational fields. Those concerned agree that students need to have stronger basic academic skills as they leave secondary education programs—stronger academic skills for graduation, for work, and for life.

The National Center has sponsored diverse efforts dealing with basic skills in vocational education, from research to development to dissemination. Much has been learned about vocational students' basic skills learning problems. In order to make connections between research and practice, The National Center has, through synthesis and development, prepared an integrated package for teacher use, reinforcing this information with practical applications gleaned from teachers' repertoires across the nation. The products in the package are aimed toward enabling vocational and academic teachers to strengthen the academic component of vocational programs through joint effort.

The **BASICS:** package provides resources in five focus areas: research findings, teaching techniques, instructional materials, instructional strategies, and support roles. The resources are organized in three looseleaf guidebooks for flexible use. An accompanying videotape provides an orientation to the topic and to the package.

The Bridger's Guide orients administrators, counselors, teachers, and employers to the purpose and application of **BASICS;** individual roles are explained, resources identified, and implementation guidelines and strategies outlined in workshop format. Individual components to the guide are as follows:

- *Implementation Guide* describes the philosophy of **BASICS** and provides guidelines for implementing the program.
- *Support Roles for Basic Skills* describes the role of administrators, counselors, employers, and families in a program for improving basic skills.
- *Primer of Exemplary Strategies* provides teachers with examples of other teachers' successful efforts and diverse approaches.
- *Roadsigns from Research*)posters and brochures) highlights key research findings of interest to those involved in strengthening basic skills.

Targeted Teaching Techniques provides vocational and academic teachers with assessment, planning, and management tools to improve students' basic skills. Individual components are as follows:

- *Technique for Management: Time for Learning* lays foundations for more effective basic skills instruction through studying the use of classroom time in teaching basic skills.

- *Technique for Remediation: Peer Tutoring* discusses the planning, implementation, and evaluation of peer tutoring programs to strengthen students' basic skills.
- *Technique for Computer Use: Software Evaluation* describes a procedure for joint evaluation of educational software for basic skills instruction.
- *Technique for Individualization: The Academic Development Plan* guides school staff through a systematic identification of individual student needs and steps to meet those needs.
- *Techniques for Joint Effort: The Vocational-Academic Approach* describes teaching techniques that vocational and academic teachers can use jointly to improve students' basic skills.

Developing an Instructional Program provides teachers with practical and theoretical information on the development or selection of appropriate applied basic skills instructional materials. Individual components are as follows:

- *Instructional Materials Development* discusses the prerequisites of materials development, alternative curriculum types, and guidelines for materials development and review.
- *Supplemental Instructional Resources* identifies sources of basic skills instructional materials for use with vocational students.
- *Instructional Assistance in Specific Basic Skills* prepares vocational teachers to help students gain reading, writing, oral communications, and math skills.

The National Center wishes to acknowledge the leadership provided to this effort by Robert E. Taylor, recently retired Executive Director. Appreciation is extended to the following individuals who served as a panel of experts to assist staff in planning strategy and recommending document content: Eugene Bottoms, Consultant to the Southern Association of Colleges and Schools; Michele Brown, Vocational Supervisor, Idaho Falls School District, ID; Alton Crews, Superintendent, Gwinnett County Public Schools, GA; Roger Faulkner, Instructor-Coordinator, Great Oaks Joint Vocational School District, OH; and Darrell Parks; Director, Division of Vocational and Career Education, Ohio Department of Education. Appreciation also is extended to Charlsie Hina, Holmes High School, Covington, KY and to Joyce Schroeder, Great Oaks Joint Vocational School District, Cincinnati, OH for their critical review of the document.

Special recognition is due the following National Center staff who played major individual roles in the development of the **BASICS** package: Richard J. Miguel, Associate Director for Applied Research and Development, and Michael R. Crowe, Project Director, for leadership and direction of the project; Sandra G. Pritz, Senior Program Associate, Judith A. Sechler, Program Associate, and June Veach, Graduate Research Associate, for synthesizing and developing the documents; and Deborah Black for word processing the documents. Appreciation is extended to The National Center editorial and media services personnel for editorial review, graphics, and production of the documents.

Chester K. Hansen
Acting Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

The instructional materials used by students and teachers are a primary factor in the learning equation. Thus, the need to search out or develop instructional materials is ever-present. The process of review and development can be complex and cumbersome without a systematic, efficient system. If the systematic approach suggested in this document is used by vocational and academic teachers working as a team, the result is likely to be a program that strengthens student basic skills through the application of academic concepts to vocational tasks.

The first major section of *Instructional Materials Development* discusses the prerequisites to development of materials. The prerequisite series of steps is designed to lay a firm foundation for development of materials in any of a variety of modes and includes:

- Conduct needs assessment
- Determine job
- Conduct job analysis
- Identify tasks for instruction
- Conduct task analysis
- Cross-correlate occupational tasks with academic skills needed
- Determine type of instructional system
- Determine need to develop, adapt, update, or supplement materials
- Specify the development task

Three types of curriculum material are presented as options for development from the preparatory work: competency-based individualized instruction, applied learning in a problem-solving mode, and lesson plans for traditional instruction. The three succeeding sections of the document are devoted to describing for each in turn the characteristics of that type of material, the rationale for use, and guidelines for development. A sample of each type of curriculum is included as an illustration of the principles discussed.

Management of the curriculum development process involves monitoring progress and controlling for quality. Monitoring is discussed with reference to controlled routing and coordination of effort. The resulting material should be reviewed for quality in two ways, internally and externally. Internally, the development team reviews the materials to determine how closely they correspond to the agreed-upon guidelines for development. Externally, teachers using the materials evaluate how well they meet the intended objectives in terms of student learning.

Introduction

The instructional materials used by students and teachers are a primary factor in the learning equation. All teachers value materials that can effectively assist them in helping students to strengthen skills—both vocational and academic. Applied learning of academics can take place only if the academic concepts in vocational programs are carefully identified and incorporated meaningfully into the instructional materials for vocational students.

The need to search out or develop instructional materials is ever-present. Even if teachers are fortunate enough to have found materials suitable for their program objectives, their students' learning needs, and their own teaching style, those materials will have to be updated periodically to stay current with changes in technology and needs of employers.

A systematic approach to instructional materials review and development is important not only because the materials themselves play such an important part in the learning equation but also because the process of review and development can be complex and cumbersome without an efficient system. Without such a system, it can be tempting to settle for less than the optimum set of materials. With such a system, it is easier to analyze exactly where and what the needs are, what types of materials will best meet the needs, and what has to be done to get those materials. If this systematic approach is used in concert by vocational and academic teachers working as a team, the result is likely to be a program that strengthens student achievement through applying academic concepts to vocational tasks.

The approach presented here is one that relies heavily on laying a firm foundation for instructional materials development. The analysis of need and of the content to be included in the materials is the same analysis regardless of the type of instructional materials to be developed ultimately. Thus the first major section discusses the prerequisites to development of materials. Once the prerequisites have been met, materials can be developed in a number of modes, and the development flows logically from the foundation already laid. Three modes are presented as options in the three succeeding sections.

- Competency-based materials
- Materials for applied learning in a problem-solving mode
- Lesson plans

The first two modes are options for student materials, while the third enables a teacher to plan for effective coordination of instruction. The three modes are not separate in all respects; features of all three (and other options as well) can be applied together. The flowchart (figure 1) on the following page shows the conceptual organization of this document. The next section describes the flow chart steps 1 through 9, whereas succeeding sections describe modes for the development of materials as illustrated by step 10. The last section describes the steps for the management of the development process.

1 CONDUCT NEEDS ASSESSMENT
2 DETERMINE JOB
3 CONDUCT JOB ANALYSIS
4 IDENTIFY TASKS FOR INSTRUCTION
5 CONDUCT TASK ANALYSIS
6 CROSS-CORRELATE OCCUPATIONAL TASKS WITH ACADEMIC SKILLS NEEDED
7 DETERMINE TYPE OF INSTRUCTIONAL SYSTEM
8 DETERMINE NEED TO DEVELOP, ADAPT, UPDATE, OR SUPPLEMENT MATERIALS
9 SPECIFY THE DEVELOPMENT TASK
10 DEVELOP MATERIALS
CBE
TRADITIONAL
PROBLEM-SOLVING
OTHER

Figure 1. Systematic approach to instructional materials development

Prerequisites to Development

A number of steps should be taken to lay a firm foundation for curriculum development. These will be discussed in sequential order as shown in figure 1.

① CONDUCT NEEDS ASSESSMENT

The need for a new curricular program or a program update should be clearly identified as a first step. Instructional materials development requires a great deal of time and effort. The decision to commit the necessary resources should be based on demonstrated knowledge of the need. This ensures careful use of the resources and also provides the motivation and incentive necessary to carry the project through to completion.

For a vocational program, the ultimate demonstration of need is that jobs are available for students who graduate with particular sets of skills. Those jobs might be entry-level positions with training beyond secondary school necessary for advancement, but certainly the focus is on available work after training.

Vocational needs assessments vary in scope and formality as well as in methods used. Evidence of the needs of business and industry can be provided by advisory committees, community surveys, and follow-up of graduates. These can be supplemented by reviewing literature on the subject. (Information on these methods can be found in Modules A-1 to A-11 of the *Performance-Based Teacher Education Modules* developed by the National Center for Research in Vocational Education.) Such evidence will form a solid base for instructional materials development for a new occupational program, or for revision of an existing program. It is important that the need be well demonstrated to add new programs, or to revise existing ones.

Other components of need may be present as well. Employers are calling for employees with higher levels of academic basic skills to meet the changing demands of occupations. The recent national studies stressing the need to strive for excellence in education have led states and districts to increase academic requirements and to demand evidence of the academic content of a course before credit can be granted toward graduation. It may be necessary to rework or expand instructional materials to meet these new academic requirements. The nature of the need and the specifics of the new requirements should be set forth clearly for all who are to be involved.

Another way to support vocational programs is to develop courses that focus on academic concepts needed in the vocational program and on vocational applications of those concepts. Examples of such courses are Technical Communications or Math for Welders. Establishing the need for such a vocational-academic, or integrated, course entails showing how the course is to complement one or more vocational programs.

② DETERMINE JOB

If the need is to develop materials to train students for a particular job and a job analysis approach is to be used, the next step is to establish the parameters of the job. A job is understood to be a specific position requiring the performance of specific tasks. A job description should be developed (or located) that will provide everyone working on the project with a common understanding of the job. The description should include—

- generally stated job tasks
- location and conditions of the job
- main job functions and job relationships

Job descriptions can be found in the *Dictionary of Occupational Titles* (DOT) published by the U.S. Employment Service and in the *Occupational Outlook Handbook* (OOH) published by the U.S. Bureau of Labor Statistics. Since job descriptions in these sources reflect a broad national perspective, they should be adapted for local applicability. It is useful to determine the range of local industrial or business employment, the nature of the firms employing such workers, and the variety of job titles used.

③ CONDUCT JOB ANALYSIS

Job analysis is a process used to identify the tasks that are important to workers in a given occupation. The resulting task list forms the basis for vocational instruction. For a new vocational program it will be important to generate or locate the entire task list. For a program update, assuming that the existing curriculum is based on a well defined task list, only verification and revision will be necessary.

A number of alternative and acceptable approaches to job analysis are available, and the situation will dictate the approach to be used. The time and effort involved must be considered along with the need to know that students will be trained for the tasks that will be required of them on the job. DACUM or "**D**eveloping **a** **C**urriculum" is a relatively new and innovative approach to job analysis that provides a viable alternative to traditional, time-consuming, and costly approaches and yet successfully identifies a solid and localized base for curriculum development. The information on the DACUM process presented here is from *DACUM Handbook* (Norton 1985) published by the National Center for Research in Vocational Education. The National Center has been actively involved with refinement of the DACUM process and with training facilitators in the process. The *DACUM Handbook* presents complete guidelines for implementing the process.

What Is DACUM?

DACUM analysis is a very effective method of quickly determining the competencies or tasks that must be performed by persons employed in a given job or occupational area at relatively low cost. The profile chart that results from the DACUM analysis is a detailed and graphic portrayal of the skills or competencies involved in the occupation being studied. A sample of a DACUM chart is provided (see table 1.).

DACUM operates on the following three premises.

1. **Expert workers** are better able to describe/define their job than anyone else.
2. Any job can be effectively and sufficiently described in terms of the **tasks** that **successful** workers in that occupation perform.
3. All tasks have direct implications for the **knowledge** and **attitudes** that workers must have in order to perform the tasks correctly.

A carefully chosen group of eight to twelve experts from the occupational area under

Table 1

WORD PROCESSING SKILL PROFILE

DUTY	COMPETENCIES							
A Use Typing Skills	(A-1) Format	(A-2) Key in Text/Data						
B Operate Terminal	(B-1) Follow Security Procedures	(B-2) Sign On	(B-3) Use Command/ Function Keys	(B-4) Use Cursor Keys	(B-5) Use 10-Key	(B-6) Diagnose Problems	(B-7) Correct Problems	(B-8) Sign Off
C Handle Storage Media	(C-1) Follow Security Procedures	(C-2) Initialize Media	(C-3) Load and Unload Media Properly	(C-4) Perform Backup Routine	(C-5) Label Media	(C-6) Maintain Media	(C-7) Store Media Properly	
D Operate Disk Drive	(D-1) Turn on Drive	(D-2) Load and Unload System Disk	(D-3) Load and Unload Archive Disk	(D-4) Diagnose Problems	(D-5) Correct Problems	(D-6) Turn Off Drive		
E Apply Machine Functions	(E-1) Determine Avail. & Approp. Mach. Functions	(E-2) Use Directory	(E-3) Retrieve Existing Text	(E-4) Use Formatting Options	(E-5) Edit	(E-6) Save Text	(E-7) Queue for Print	(E-8) Search
Apply Machine Functions (cont.)	(E-9) Merge	(E-10) Sort	(E-11) Use Math	(E-12) Use Glossary	(E-13) Index	(E-14) Use Various Column Functions	(E-15) Replace	(E-16) Copy
Apply Machine Functions (cont.)	(E-17) Move	(E-18) Use Emphasis Functions	(E-19) Use Telecommunications	(E-20) Convert WP to DP and Vice Versa				
F Use Text Refinement Techniques	(F-1) Use Required Hyphen and Spacing	(F-2) Use Tabs Appropriately	(F-3) Use Approp. Indentation Options	(F-4) Use Footnotes	(F-5) Use Headings and Trailers (Footers)	(F-6) Use Automatic Pagination and Numbering	(F-7) Use Superscript and Subscript	(F-8) Use Automatic Outlining
G Use English Skills	(G-1) Check Spelling	(G-2) Use Correct Grammar	(G-3) Use Correct Punctuation	(G-4) Check for Text Clarity	(G-5) Check for Text Consistency	(G-6) Proofread		
H Operate Printers	(H-1) Follow Security Procedures	(H-2) Change Ribbon	(H-3) Change Printwheel (Matrix) (Band)	(H-4) Load or Unload Paper as Required	(H-5) Install Printer Attachments	(H-6) Diagnose Problems	(H-7) Correct Problems	(H-8) Use Phototypesetter
I Operate Central Processor	(I-1) Shut Down System	(I-2) Bring Up System	(I-3) Use Utility Functions	(I-4) Perform Recovery Procedures	(I-5) Update Software	(I-6) Diagnose Problems	(I-7) Correct Problems	
J Use Reference Material	(J-1) Refer to Operator's Manual	(J-2) Follow Company Policy & Procedures Manual	(J-3) Refer to Style Guide	(J-4) Use Standard Reference Material				
K Use Office Machines	(K-1) Transcribe from Dictation Equipment	(K-2) Use Copy Machine	(K-3) Use Optical Character Reader					
L Communicate with Others	(L-1) Clarify Instructions with Customer	(L-2) Accept Constructive Criticism	(L-3) Handle Unreasonable Requests Tactfully	(L-4) Establish Good Rapport with Management	(L-5) Establish Interface w. Other Areas of Operation	(L-6) Use Computer Terminology	(L-7) Express Machine Capability	(L-8) Forward Information to Management
Communicate with Others (Cont.)	(L-9) Forward Info. Concerning Systems	(L-10) Order Supplies						
M Adapt to Changing Needs	(M-1) Continue Education	(M-2) Experiment with Machine Functions	(M-3) Use Good Problem-Solving Techniques	(M-4) Participate in Users' Info. Groups	(M-5) Read Trade Information Publications	(M-6) Attend Seminars and Trade Shows	(M-7) Familiarize Yourself with Other Systems	

WORD PROCESSING

consideration form the DACUM committee. Committee members are recruited directly from business, industry, or the professions. The committee works under the guidance of a facilitator for two to three days to develop the DACUM chart. Modified small-group brainstorming techniques are used to obtain the collective expertise and consensus of the committee.

The DACUM committee is carefully guided by the facilitator through each of the following steps:

1. Orientation to DACUM
2. Review of job or occupational area definition
3. Identification of general areas of competence (duties)
4. Identification of specific tasks performed in each of the general areas of competence
5. Review and refining of task and duty statements so that they begin with an action verb indicating what a person *does*, followed by an object—the element acted upon, and sometimes a qualifier)
6. Sequencing of task and duty statements
7. Identification of entry-level tasks
8. Other options, as desired

The DACUM process usually results in 100 to 200 task statements (also referred to as competencies) that outline *what* a successful worker in a particular job or cluster of related jobs must be able to do. These tasks are then commonly submitted to a larger but still select group of workers and/or their immediate supervisors for verification purposes.

Although the DACUM process has been used for several purposes, it is ideally suited for researching (1) the competencies that should be addressed in the development of new training programs, (2) the competencies that should be delivered by existing training programs, and (3) the current relevance of existing DACUM charts.

One additional benefit of DACUM is its public relations value to the educational institution doing the DACUM. Many schools that have used DACUM report such reactions as the following:

- Offers of equipment and supplies
- Offers of resource persons to help teach in emerging technology areas
- Requests for inservice training programs to meet local industry needs
- Greatly increased support of the educational institution in a variety of ways by local business and industry, labor, and management

Modified DACUM

DACUM has also been used in special applications of the usual process. In some situations, qualified workers cannot be released for a 2-day workshop. In other cases, resources have proven too limited for the entire process. Sometimes if the purpose of the job analysis is for update rather than development of a new program, a shortcut method has been sought.

A modified DACUM depends on the use of existing task lists that the panel is asked to review. One day has generally been adequate for the panel to review and accept, modify, or reject each general area of competence and task statement derived from the existing lists. Caution should be exercised in using existing lists. The lists may be out of date or may not reflect tasks performed by local workers.

Sources of task lists include the following:

- State curriculum laboratories (e.g., Ohio State University, Colorado State University, and the Oklahoma State Department of Vocational and Technical Education)
- The six regional curriculum centers, one of which, the East Central Network for Curriculum Coordination (ECNCC) in Springfield, Illinois, has established a Task List Access System

- The Vocational-Technical Education Consortium of States (V-TECS) in Atlanta, Georgia
- The DACUM Exchange (DEX) at Humber College in Toronto, Canada
- Open Entries, a national competency-based vocational education information exchange network at Florida State University in Tallahassee
- Curriculum guides as available

④ IDENTIFY TASKS FOR INSTRUCTION

After detailed information has been collected about the requirements of a job, the next step is to select those tasks that are best taught in the classroom; this means deleting tasks that are best taught on the job (on-the-job training or OJT) and those that do not require any type of instruction or training.

In the early stages, those developing a course must be guided by their own judgment and past experience. Later, as the evaluation process feeds back information on instructional effectiveness, the course can be adjusted more objectively. However, until this feedback occurs, judgments should be made by people who know the curriculum and who know the kind of person likely to succeed in a particular job.

A task selected for school instruction should meet at least one of the selection criteria listed below.

- Task is performed by a large percentage of jobholders.
- Task is performed frequently.
- Task is critical to job accomplishment.
- Task is essential in performance of another task.
- Task is required immediately upon entry into job.

The following are criteria for deciding that the task should be learned on the job.

- Task is relatively easy to learn.
- Task is performed infrequently.
- Task is performed by a small percentage of jobholders.

The following criteria are reasons for rejecting a task for either instruction or training. Either reason would be sufficient for rejection.

- Task can be performed without further instruction.
- Task is similar to other tasks selected for instruction.

In many cases, decisions to teach a task in school rather than train for it on the job will be relatively simple to make, due to known restrictions on personnel, equipment, facilities, or time. Similarly, many tasks clearly will be within the capabilities of on-the-job training. However, decisions that are not clear-cut—for example, decisions that school instruction is desirable but only because it is relatively more efficient than on-the-job training—could be subject to change later. Each task subject to such a marginal decision must be noted so that if constraints on school resources or course length dictate, the task can be converted to an on-the-job training requirement.*

⑤ CONDUCT TASK ANALYSIS

The tasks that are verified as important from the job analysis become the basis for modules or other units of instruction in the educational program. During the instructional development phase that follows the DACUM process, the verified tasks undergo a *task analysis*. Task analysis is the process of analyzing each task identified for instruction to determine *at least* the following:

- Steps involved in performing the task (in sequence so far as possible)
- Knowledge required to perform the task
- Attitudes that are important to task performance

*This section is adapted from Appleby (1981).

Task analysis may also include identifying:

- Safety considerations
- Tools, equipment, and materials
- Standards for performance

No matter how instruction is to be delivered, a thorough task analysis is a must. It is at this stage that the specific content of an instructional program is identified and placed within a meaningful framework. A task analysis provides a firm foundation from which instructional materials development can proceed.

Specify the Requirements

The task analysis process involves breaking the identified tasks down into successively more detailed components or levels. The task analysis should be geared to the purpose it will serve and the level of specificity required. The goal is to provide the level of specificity needed for effective instruction but to avoid unnecessary detail. Here are several examples of the task analysis process.

- If the task analysis will serve as the basis for curriculum update, and if any additional or revised materials will be implanted in an existing set of materials, tasks should be analyzed to the same level as the existing curriculum.
- If the task analysis will be used to judge the need for curriculum update, the comparison with existing materials will be easier if the tasks are analyzed to the same level.
- If new instructional materials are to be developed, the level of task analysis depends on variables such as the following:
  - —Type of instruction (competency-based individualized modules require more detail than lesson plans that will be "filled in" by a teacher.)
  - —Student population (If students have low levels of basic skills, the need is heightened to analyze tasks to a fine level for the sake of clarity and simplicity.)
  - —Length of program (Time is a consideration in whether specific detail as well as basic skills support can be incorporated.)
  - —Standards imposed by the importance of the task (How difficult is it to learn the task, and/or the consequences of inadequate task performance and so forth.)

Several options are open as to who should do the task analysis, and this decision, too, will depend on the circumstances. In general, someone holding the job for which instruction is being developed should be involved. A teacher curriculum developer can work with a job incumbent or can go to the job site to observe and interview. Workers can be brought in to a school or curriculum center. A team of instructors can work on the analysis with reference materials and then ask a job incumbent to review the analysis.

Task analysis forms should be provided to whoever is doing the analysis so that the analysis will be systematic and standardized. The two types of sample forms provided here have been used successfully. Form A (tables 2 and 3) is suitable for a general analysis, perhaps to be used to update or supplement instruction. Form B (tables 4 and 5) is more suitable for new course development.

List the Steps (or Component Parts) of Each Task

The steps, or component parts of the task breakdown, should be listed in the first column of the task analysis form. (See column 1 of tables 3 and 5.) Some helpful procedures to follow in listing the steps are—

- break each task into at least two (and usually more) steps,
- list the steps in their normal sequence,
- list as steps *all* the actions necessary to complete a task,

TABLE 2

TASK ANALYSIS FORM A*

Task # _____ - _____

In performing this task the _____ **will need to:**

COMPLETE THESE STEPS	KNOW THE FOLLOWING	EXHIBIT THESE ATTITUDES
1.		

*Use additional pages if needed. Steps should be sequenced in their likely order of occurrence. All knowledge and attitude items should be related to a step statement.

TABLE 3

TASK ANALYSIS FORM A—SAMPLE

Task—Produce business letters

In performing this task, the secretary will need to:

COMPLETE THESE STEPS	KNOW THE FOLLOWING	EXHIBIT THESE ATTITUDES
1. Select appropriate materials	Types of stationery Type styles Number and type of copies needed	
2. Use correct letter format	Business letter parts Business letter styles	
3. Check for correct punctuation and spelling	Punctuation and spelling rules	
4. Edit letter as needed	Editing procedures	Caring attitudes
5. Type letter	Accurate and efficient operation of typewriters	Exhibit concern for quality of finished product
6. Make appropriate corrections	Correction materials Correction procedures	Appreciation for accuracy and neatness
7. Proof completed letter	Proofreading skills	Appreciation for accuracy and neatness

TABLE 4

TASK ANALYSIS FORM B

Duty:
Task:

	Standards (how well)	Tools and Materials	Safety	Related Knowledge			Attitudes
				Science	Math	Language	

TABLE 5

TASK ANALYSIS FORM B—SAMPLE

SECRETARY

Duty: _____ PREPARE WRITTEN DOCUMENTS

Task: _____ PREPARE A BUSINESS LETTER

	Standards (how well)	Tools and Materials	Safety	Related Knowledge			Attitudes
				Science	Math	Language	
1. Decide on letter format	business letter format used					understand business letter format	
2. Select materials	appropriate letterhead appropriate type style	stationery typeheads	avoid paper cuts			type styles	
3. Check draft for spelling, punctuation, and editing	error free					editing skills, grammar, spelling, and punctuation	caring attitude
4. Edit letter as needed		pencil/ pen					
5. Type letter	error free	typewriter or word processor		typewriter or word processor			concern for quality
6. Proofread letter							
7. Make corrections or retype		typewriter or word processor					
8. Make final check	error free neat					proofreading skills	appreciation for accuracy and neatness
9. Submit to writer	within reasonable time						

- state steps that represent specific teaching points, and
- use action verbs to describe the step.

The form used should reflect the level of detail decided on previously. If the task can be adequately described by breaking it down into the steps involved, a two-level breakdown is appropriate. An example of a two-level breakdown is the following:

Structure	**Example**
Task (Level 1)	Task: Produce a line negative
Step 1 Step 2 Step 3 } (Level 2)	Step 1: Prepare the darkroom Step 2: Prepare the camera Step 3: Make the exposure Step 4: Process the negative

If a more detailed (say, a four-level breakdown is indicated, it can be handled as follows:

Structure	
Task (Level 1) Operation (Level 2) Step (Level 3) Procedure (Level 4)	(In this case, a task is broken up into its component operations. Operations are viewed as logical groupings of steps, and procedures tell what to do to perform a step.)

An example showing a four-level breakdown is provided below.

Task: Produce a line negative

Operation: Prepare the darkroom

Step 1: Prepare the processing chemicals.

Procedures:
a. Place three trays in the sink.
b. Measure the correct amount of developer (1/2 part A to 1/2 part B).
c. Pour mixed developer into the first tray.
d. Pour 1/2-inch of stop bath into the second tray.
e. Pour 1/2-inch of fixer into the third tray.

Step 2: Prepare the sink.

Procedures:
a. Plug necessary drain holes.
b. Fill the sink with enough 68° water to match the level of the chemicals in the trays or a minimum of 1/2-inch.
c. Adjust running water to 68° and allow it to flow into the rinse tub of the sink and drain out an overflow.

Step 3: Turn off the room lights and turn on the darkroom safelights.

Analysis of the tasks to the desired level of specificity is a major element in the development of effective instructional materials.

Identify All Related Knowledge

Although the tasks and steps have been stated with action verbs so that the focus is on what the student will be able to do to demonstrate learning, it is imperative to identify the knowledge and understanding that are essential to performing the skill. (See column 2 of table 3 and columns 5-7 of table 5.) This provides the opportunity to lay the groundwork for the strengthening of basic skills and for vocational and academic teachers to work together on this effort. This is so important an aspect of development for the purposes of BASICS, that a separate section of this chapter is devoted to a discussion of the cross-correlation of vocational tasks with academic concepts.

Suffice it to say here that related knowledge enables (but does not guarantee) performance. The careful and explicit identification of the concepts from specific academic disciplines (typically, math, science, and language are separated for task analysis) that are needed for specific vocational tasks (and steps of tasks) is a major aspect of helping students apply learning.

Identify Attitudes Important to Task Performance

The idea that certain attitudes or traits are important to performing the task on the job is often overlooked or taken for granted. However, employers regard them as important to successful performance on the job, so training programs should inform students about them. For example, a concern for neatness is important for a secretary in the preparation of a business letter, and precision for a carpenter in doing finishing work. Some of these traits may apply to entire tasks, while others may be of special note for steps. (See column 3 of table 3 and column 8 of table 5.)

List Items Needed for Tasks

For a course to run smoothly, the items needed for the tasks must be readily available to the students. The task analysis phase is a good time to list these as each step is considered separately. Tools, equipment, materials, and supplies should be listed on a step-by-step basis. Then these lists will be available for use in the instructional materials and can also be compiled easily for procurement. (See column 3 of table 5.)

Identify Safety Concerns

Some jobs/tasks have many safety concerns, whereas others have only a few. It is important to consider each step of each task for hazards that may be encountered so that these can be noted in the instructional materials along with precautionary measures. Some safety concerns are associated with tools and equipment, such as the need for eye protection when using a welding torch. Others are associated with materials, such as chemicals used in landscaping. (See column 4 of table 5.)

Identify Standards for Performance

For students to be aware of what parts of each task are important and how their performance will be evaluated, the standards must be explicit. Some curriculum developers prefer to defer step-by-step standards to a later stage in the development process, whereas others feel that the task analysis process lends itself to specifying criteria for acceptable performance. Standards for student assessment at the task level should at least be identified, and these should be specific, observable, and measurable. The standards may involve an acceptable type of output, or product and/or an acceptable sequence of steps or process. Often these are dictated by industry standards for the vocation. (See column 2 of table 5.)

Overall Considerations

When the analysis of each task has been completed, the entire task analysis product should be reviewed for consistency by one person. If a worker on the job has not been involved in the task analysis process, this is the time to ask for such a review. The establishment of a thorough and valid task analysis as a basis for development ensures that effective instructional materials will result.

Someone involved in instruction should review the task analysis to see if the tasks should be resequenced for instructional reasons. For example, some of the easier tasks could be placed at the beginning of the instructional program while more complex tasks could be reserved for later in the program. At this time it is also helpful to see if any tasks can be grouped for instructional purposes. For example, if several occupational tasks involve testing samples for chemical composition, it may be possible to cover obtaining samples once even if it is necessary to handle evaluation of each sample in a different way.

⑥ CROSS-CORRELATE OCCUPATIONAL TASKS WITH ACADEMIC SKILLS NEEDED

The explicit identification of the concepts from specific academic disciplines that are needed for specific vocational tasks is a major aspect of helping students strengthen their basic skills and apply learning. Vocational programs relate basic skills directly to occupational tasks. The task analysis phase of preparing to develop instructional materials is a logical and functional time to work on this cross-correlation. The following three assumptions are widely held as valid:

- Academic skills are embedded in vocational tasks.
- Vocational tasks provide for realistic use of academic basic skills; connecting academic learning with application will strengthen students' basic skills.
- Neither academic basic skills nor vocational skills should be taught in isolation from each other; teachers need to make students aware of the bonding between academic basic skills and vocational tasks.

To follow this line of reasoning, it is critical that both vocational and academic teachers be fully aware of the specific cross-correlations within their courses. To improve student performance, teachers should build visibility of those correlations into their instructional materials.

The academic teacher can identify the academic concepts in the form in which they would be found in an academically-organized course. Aside from completing the task analysis, at least two other important functions can be served. One is a validation of instructional time devoted to academic skills in vocational programs. This validation can be used to determine where academic credit can be awarded within vocational programs. The granting of academic credit toward graduation requirements has become increasingly important as academic requirements have been expanded over recent years. A validation of a task-by-task nature gives helpful specific documentation.

For example, in the state of Vermont, 1 year's equivalency credit toward graduation is recommended for 120 instructional hours in a subject area. A 1984-85 study involving cross-correlation revealed on a matrix display where at least 120 instructional hours in an academic area could be validated over a period of 2 years in a vocational program. (A sample matrix for electronics and mathematics is shown in table 6.) A succeeding study reviewed the quality of course content objectives in relation to the time spent. These studies are being used to prepare guidelines that will help schools to enable students to meet graduation requirements in both vocational and academic programs.

A variation of the cross-correlation matrix shown has been used successfully to indicate level of learning of an academic skill in a vocational task. That is, to use a code number—rather than a dot—in the cells of the matrix to correspond to a level of learning (e.g., 1 for comprehension, 2 for application, 3 for problem-solving). This enables teachers to see if courses provide for academic skills to be developed to the desired level.

Another function that can be served by cross-correlating vocational tasks and academic skills is to provide a foundation for development of academic courses related to specific vocational courses or service areas. An example of such a course is the Technical Writing and Communication Skills course taught for English credit at the Great Oaks JVSD in Cincinnati, Ohio. Table 7 shows one portion of the correlation of vocational and academic objectives and tasks for the auto mechanics area. Teachers have gone beyond establishing a correlation of skills by working jointly to sequence the academic content in accordance with the vocational curriculum insofar as possible. Figure 2, from a vocationally-related academic course at Great Oaks JVSD, shows a portion of the scope and sequence of objectives for an applied mathematics course for students in an animal care program. A cross-correlation of vocational tasks and academic skills can be done in a number of ways for a number of different purposes.

⑦ DETERMINE TYPE OF INSTRUCTIONAL SYSTEM

To determine the type of instructional system that will be most effective in a given situation, a number of factors should be considered with reference to the characteristics of different types of instructional systems.

Factors to Consider

Once the course content has been established, developers need to decide on the type of instructional system that will best meet their goals. Certainly the major goal in developing any instructional program is to develop the most effective and efficient program possible for advancing student achievement.

Some of the factors that influence the choice of instructional approach are as follows:

- Your philosophy of education
- Philosophy of your institution/agency
- Time available for development before instruction
- Money available for program development
- Instructional support services available
- Instructional facilities available
- The target student population

With reference to the target student population, aspects to consider include their specific knowledge, skills and attitudes relevant to the subject of the course as well as their motivation and interests. Many of the following functions of instruction should be carried out by the program:

- Gaining and maintaining student attention
- Informing the student of the objective
- Assisting students in recalling relevant learning
- Providing students an opportunity to perform
- Giving feedback on the performance
- Assessing the student's performance
- Providing opportunities for retention and transfer

TABLE 6

SAMPLE CROSS-CORRELATIONAL MATRIX DISPLAY

ELECTRONICS	Atomic Theory	Sources of Energy	Circuit Fundamentals	Fabrication	Scientific Calculation	Resistance (REI)	Study of Measurement	Ohm's Law	Series Circuits	Parallel Circuits	Series/Parallel Circuits	Magnetism	Nature of Alternating Current	Safety Devices	Network Theorems	AC Generations	Inductance	Inductive Reactance	Capacitance	RC Time Constants	Capacitive Reactance	Series RCL Circuits	Parallel RCL Circuits	Complex Numbers	Resonance	Vacuum Tubes	Servo Systems	Nature of NP Junction	Rectifiers	Filters	Special Semiconductive Diode	Bipolar Junction Transitors	Transistor Circuits	Transistor Amplifiers	OP Amplifiers	Logic Devices	Computer Math	Boolean Algebra	Wave Shaping	Modulation	Transmission Lines	Antenna Theory	Computer Programming
Mathematical Skills	←					(BASIC ELECTRICITY)																	→																					
Area					•	•	•					•				•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•				•	•	•	•		
Volume		•		•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•				•	•	•		
Basic Whole Number Skills	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Computers and Calculators	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Coordinate Geometry																•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Decimals	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Directed Number (+, -)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Exponents, Powers, Roots	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Formulas and Equations	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Fractions	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Geometric Plane Figures			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Graphs and Tables			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Logarithms																																	•	•								
Matrices																																											•
Measurement, Lineal	•		•	•	•	•	•					•		•		•	•		•	•		•	•		•		•											•	•	•	•		
Measurement, Electrical		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•		
Parallels and Perpendiculars												•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•				•	•	•	•	
Percents	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Polynomials	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Products and Factors	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Ratio and Proportion	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Rational & Irrational Numbers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Solving Inequalities																								•	•		•															•
Special Triangles												•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•				•	•	•	•	
Trigonometry												•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•				•	•	•	•	
Vector Applications												•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•				•	•	•	•	
Metric Prefix	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•
Base Number Systems																																			•	•						
Boolean Algebra																																			•	•	•					

COMMITTEE:

Bill Ford, Burlington High School
Bill Richards, Essex Junction Area Vocational Center
Richard Robinson, Rutland Area Vocational Center
Luther Tabor, Trade and Industry Consultant

We recommend that Electronics full program completers be granted Math equivalency credit.

MAY 20, 1985

Each dot represents 24 minutes or more of instruction

SOURCE: Ericson et al. (1986)

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TABLE 7

CORRELATION OF VOCATIONAL AND ACADEMIC OBJECTIVES AND TASKS FOR THE AUTO MECHANICS AREA

VOCATIONAL		ACADEMIC	
Auto Mechanics Objectives	Auto Mechanics Activities	Communications Activities	Communications Objectives
Unit: Service Brake Systems (4 weeks) Given various brake system components, equipment, tools, materials, instructions, and the observance of all safety precautions, the student will disassemble, diagnose, overhaul, and reassemble components in accordance with manufacturer's specifications and stipulated operable conditions. All machining operations must be acceptable to industry finishes and tolerances. All vehicle brake systems will be restored to a safe operable condition according to industry standards and instructor's satisfaction.	Remove and replace drums Inspect brake lining, drums, and hardware Check and inspect hydraulic system Recondition drums Check operation of parking brake Service and/or replace parking brake components Replace steel brake lines and/or fittings Cut, bend, and double flare steel brake lines Bleed brakes manually Bleed brakes with pressure bleeder Remove and replace brake shoes Adjust brakes Remove and rebuild sliding calipers Remove and rebuild floating calipers Inspect and recondition rotors Repack wheel bearings Remove and replace wheel bearings Test and replace power boosters Remove and replace brake system control valves Overhaul wheel cylinder Remove and replace master cylinder Flush brake system	Study Motor *Auto Repair Manual* sections on disc brakes. Take quizzes on vocabulary, interpreting diagrams, and following directions. With a study guide, read and discuss Occupational Safety and Health Act (OSHA) (standards, enforcement, results, implications) With the help of the *Reader's Guide*, locate, read and discuss articles in periodicals on seat belt legislation, air bags, and other measures to cut down on serious injuries and/or accidents. Read and discuss the following poems: "Southbound on the Freeway" by May Swenson "The Scarred Girl" by James Dickey "Highway: Michigan" by Theodore Roethke "Traveling Through the Dark" by William Stafford "The Flat" by Laurence Lieberman "Model T" by Adrian Stoutenberg "Auto Wreck" by Karl Shapiro	Read, interpret, discuss, and apply information—including charts and diagrams Learn and practice library skills: Locate information in *Reader's Guide to Periodical Literature* Read and analyze articles in periodicals and newspapers Read and discuss various types of poems and short stories Write poems and/or short stories by following the steps of the writing process Develop and apply listening, note-taking, and evaluation skills Organize information and present an oral report or multi-media presentation Practice peer response activities (poems, stories, and oral reports and presentations)

SOURCE: Great Oaks JVSD, Cincinnati, OH.

Outcome 1

The student will use a linear scale with accuracy.

Objectives:

*1.1 Read a fractional inch rule to 1/32 inch
*1.2 Recognize equivalent fractional parts on a ruler
1.3 Use a linear scale and the concept of ratio in making simple scale drawings

Outcome 2

The student will have a working knowledge of the metric system.

Objectives:

*2.1 Understand the prefixes associated with place values
*2.2 Perform conversions in linear measure
*2.3 Utilize a conversion factor in customary measure to metric measure
*2.4 Perform conversions in liquid measure
*2.5 Use equivalent charts in measuring volumes of fluids
2.6 Express Fahrenheit temperature readings in Celsius temperature readings and vice versa

Outcome 3

The student will calculate ratios, proportions, and percents as they relate to animal care.

Objectives:

*3.1 Compare quantities using ratios
*3.2 Identify mean terms and extreme terms in a proportion
*3.3 Determine if a proportion is an equality using the means and extremes
*3.4 Determine the unknown component in a simple proportion
*3.5 Express ratios, fractions, and decimals as percents
*3.6 Express percents as equivalent fractions or decimals
*3.7 Express fractional, decimal, and percent equivalents
*3.8 Determine unknown quantities involving percents by using proportions and using percent equations
*3.9 Find the percent of increase and the percent of decrease
*3.10 Perform calculations using two or more percents
*3.11 Estimate answers using percents

*Denotes critical objectives

Figure 2. Great Oaks Joint Vocational School District: applied mathematics—animal care.

Different students require different degrees of attention on these functions.

Types of Instructional Systems

Several types of instructional systems have distinctive characteristics that can be usefully compared. Some of the salient characteristics of three types of instructional systems are listed in table 8. The table should be examined to obtain an understanding of the major aspects of each instructional system. Many teachers adapt and/or combine aspects of different systems; they use parts of each system depending on the topic and the needs of the students. Therefore no hard and fast lines should be drawn among the systems. These three types will be targeted for additional instructional development detail in the following chapters of this guide:

- Competency-based individualized instruction
- Instruction focusing on a problem-solving mode
- Traditional or conventional instruction

⑧ DETERMINE NEED TO DEVELOP, ADAPT, UPDATE, OR SUPPLEMENT MATERIALS

Curriculum development is demanding in terms of time, effort, and other resources. A careful determination should be made of what needs to be developed, given the materials already available.

List Criteria

When the task analysis and the cross-correlation have been completed and the type of instructional system has been selected, the next step is to review materials. The content and the desired parameters have been established, and these help form the criteria against which materials are measured.

The criteria should be listed explicitly from a list of the desired characteristics for the program. It is helpful to write these criteria on one side of a matrix with the task headings on the second side to create a review form (see table 9). Comments about how well materials meet the criteria can be written in the matrix cells on a task-by-task basis. One source may do a complete and excellent job of covering one task on the task analysis, but give only cursory coverage to another, or perhaps fail to use state-of-the-art knowledge on another. The resource review form keeps the data well organized and also keeps the review on track.

Sometimes it is helpful to include style criteria explicitly to be sure that they are not overlooked or taken for granted during the review process. One example is sex equity. A checklist of items to keep in mind when reviewing materials for sex equity is included as appendix A. Such checklists can be used to back up and provide amplification for criteria listed more succinctly on a review form.

Measure an Existing Course Against the Criteria

If the objective is to find out if an existing course or program needs to be supplemented or updated, the materials for the existing course should be reviewed on a task-by-task basis. The review should measure the materials against the content listed in the task analysis and the criteria listed on the review form. The outcome will be a specific list of where adjustments need to be made and the specific nature of the adjustments. Such a list is conducive to proceeding with the updating or supplementation in an organized and efficient manner.

Locate Materials and Resources

If instructional materials have already been developed that meet the criteria or that would

TABLE 8

COMPARISON OF CHARACTERISTICS OF INSTRUCTIONAL SYSTEMS

Types of Instructional Systems		
Competency-Based Individualized Instruction	Problem-Solving Mode of Instruction	Traditional Instruction
• based on performance of competencies • specific behavioral objectives • individually paced; open entry, open exit • focused on individual needs • teacher guided • criterion-referenced evaluation with objective criteria and immediate feedback • modules and media materials	• Problem-solving and decision making processes and competencies are embedded in the activities. • Activities are participatory in nature and related to the real world and real consequences. • Reinforcement of basic skills information needed in the situation is provided along with a suitable degree of guidance on how to proceed.	• teacher directed with lesson plan for lectures, demonstrations • student materials of a textbook/ workbook form • content-based and time-based • group paced and group-oriented • relatively infrequent feedback • general objectives • norm-referenced evaluation with possibility of subjective criteria

TABLE 9

TASK REVIEW MATRIX

Resource Review Worksheet

Title: **Date:**
Author: **Price:**
Source/Publisher:
Mode:

Criteria	Task:	Task:	Task:	Task:	Task:	Task:
Valid content, accepted, modern						
Suitable level and degree of competence						
Acceptable learning strategy and mode						
Individualized and competency-based						
Usable as is						
Usable after adaptation						
Not usable						

Overall Rating

Comments

meet the criteria if adapted somewhat, a tremendous amount of time, energy, and money can be saved. Therefore, it is worth spending some effort on the search for materials that are usable.

Some materials and resources will be available at local schools and through university libraries. Colleagues in the field may be aware of available materials. A list of some sources of information is provided in the BASICS *Bridger's Guide*. However, the most efficient way to locate curriculum materials quickly and easily is through a computerized system of information.

The Vocational Education Curriculum Materials (VECM) database is a comprehensive, centralized, computerized database of information on curriculum materials. Its development was the result of a cooperative effort by the six curriculum coordination centers (CCCs) of the National Network for Curriculum Coordination in Vocational-Technical Education (NNCCVTE) and the National Center for Research in Vocational Education.

Only current vocational and technical curriculum materials that have national availability are entered into VECM. Over 5000 records of both print and nonprint materials (including over 900 microcomputer courseware entries) are now in the database and the number is continually increasing. A current emphasis is the entry of information on curriculum materials for special needs populations. The VECM database is a public file available through the Bibliographic Retrieval Services, Inc. The National Center sponsors retrieval training sessions specific to VECM. The activity is sponsored by the Office of Vocational and Adult Education, U.S. Department of Education. For specific information about the database, contact Shirley A. Chase, Ph.d., The National Center for Research in Vocational Education, The Ohio State University, 1960 Kenny Road, Columbus, Ohio 43210, 614/486-3655 or toll free 800/848-4815 within the continental U.S. (except Ohio). ADVOCNET-AVO0010.

The outcome of a database search is an annotated bibliography. Each VECM entry includes the following information about the curriculum product: title, date, sponsoring agency, developer, subject matter classification, educational level, intended user, student target population, description of the print or nonprint materials, copyright restrictions, and availability source. The annotated bibliography should be examined in light of the program criteria and potentially helpful materials noted.

Generally, review copies of materials that seem promising can be obtained on a loan or approval basis. However, sufficient time should be allowed for requests to be processed and materials mailed. If the budget allows for phoned requests, this can save some time.

The evaluation of the available materials against the task analysis and the review form will generally yield many helpful resources for development purpose and may yield materials that can be used "as is" or with adaptation. People are tremendous resources also. When gaps are found in the resources, it is possible to interview and observe workers on the job or obtain assistance from their supervisors.

⑨ SPECIFY THE DEVELOPMENT TASK

Specification of the development task includes developing an outline, designing program guidelines, and scheduling the development effort.

Develop an Outline

The task analysis details the scope and sequence of the course, but it is sometimes helpful to develop a one- or two-page outline that indicates broad topics or groupings of tasks and how they will be covered. Such an outline gives an overall perspective that is sometimes lost in the detail of the task analysis. The job analysis conducted earlier may give a summary at about the right level of specificity. If the

DACUM process has been used for job analysis, the resulting DACUM chart serves the purpose of an outline very well, because tasks are grouped into duty areas. Aside from helping everyone involved in the instructional materials development to share the overall perspective, the outline points up the groupings that can form a logical basis for dividing up the development task.

Design Program Guidelines

The design of the program guidelines that control the instructional materials development process is termed conceptualization. The requirements for the vocational program have been well thought out in the foregoing activities. The instructional requirements have been established. These must be coupled with the use of techniques consistent with effective learning principles in the design of the desired instructional materials. Time spent at this stage is a very good investment. Time must be built into the schedule for careful, thoughtful conceptualization. Changes partway through a project are possible, but they are costly. Time invested here will reap dividends during the "crank out the modules" phase.

Select Instructional Methods

One aspect of the design is the selection of instructional methods. The size of the budget has a good deal to do with the menu of options that can be considered for any one development effort, especially when it comes to mediation. However, some nonmediated methods of delivery that are relatively cost-free (e.g., lecture, demonstration, simulation, performance, independent study) are better suited to one task than another. For this reason the person designing the curriculum may want to specify the range of options for the developers and let each choose the most suitable method(s) for the task. The other important factor is the student population and their learning styles. To maximize learning for a variety of different student learning styles and characteristics, it is well to select a variety and some combinations of instructional methods. (See BASICS' *Learning/Teaching Styles*.) Following is a list of sample methods and types of learning activities:

- Audiotape
- Brainstorming
- Bulletin board
- Buzz groups
- Chalkboard
- Committees
- Community study
- Computer
- Debates
- Demonstration
- Discovery
- Discussion
- Displays
- Dramatizations
- Drill and practice
- Exhibits
- Fields trips/research
- Film loops
- Films
- Filmstrips
- Flannel boards
- Flip chart
- Games
- Graphics
- Homework assignment
- Illustrated talk
- Independent study
- Information sheets
- Investigation/reporting
- Laboratory work
- Large-group/small-group instruction
- Library research
- Listening
- Listing or diagramming
- Models
- Oral recitation
- Panels/symposiums
- Problem-solving
- Programmed materials
- Projects
- Question and answer
- Reading out loud
- Real objects
- Resource persons
- Review
- Role-playing
- Simulation
- Slides
- Speaking
- Step-by-step procedure panels
- Supervised study
- Team teaching
- Television
- Transparencies
- Verbal illustrations
- Videotape or videodisc
- Visual illustrations
- Work-study
- Writing

(Source: *Develop a Lesson Plan*, Module B-4, 1979)

Below are some of the factors to be considered, especially when mediated modes are an option.

- **Appropriateness:** What is its potential for enabling the learner to attain the performance objective?
- **Quality:** Is it durable? Is it well made? When appropriate, is it legible, visible, and/or audible?
- **Availability:** Is it available? Can it be serviced? Can students access it when needed? Is it compatible with present equipment?
- **Cost:** Is it worth the expenditure? Is it affordable?

The most important factor is appropriateness, but the other factors must also be considered.

When determining if a media mode is appropriate, consider the academic or intellectual level of the students, as well as any cultural characteristics that may influence the effectiveness of the media. And, consider the skill the learner is trying to attain. Is it essential for the learner to *see* or *use* a piece of equipment to learn this skill? Does the learner need to interact with others in order to acquire this skill? Are audible sounds an important aspect of the job task being practiced by the learner? Are experiments or simulations essential to the unit?

The following media matrix worksheet (table 10) provides a framework for use in selecting the best mode for a task.

Develop a Prototype and Guidelines for Development

The design of the materials should be conveyed for all instructional materials developers in two companion documents: A prototype or sample of a module (learning activity, or whatever has been chosen) and guidelines for development.

A prototype of the materials to be developed serves a number of functions:

- Serves as a way to ensure that all of the ideas the curriculum designer has in mind actually work out in the materials. Abstract conceptualization becomes concrete.
- Provides a vehicle for discussion, refinement and improvement. The prototype should be used in a curriculum writer's workshop with these purposes in mind.
- Ensures that everyone involved in the development process has a common idea of what the end result is to be. At the workshop, each element of the materials can be discussed in concrete terms; people have a chance to ask questions and offer opinions with a specific example at hand.
- Provides a continuing reference for everyone working on the project. Each person's copy of the prototype and guidelines will be well worn by the end of the project.
- Displays the selected format.

The last item noted, format, deserves some additional discussion. Format is really the physical aspect of the development guidelines. The two are inextricably linked together. Instructional materials are intended to communicate a message in a specific way. The communication is affected not only by the words and graphics selected, but also by how they are presented.

The format of the materials takes on added importance for a training program that is complex, lengthy, or highly technical in nature. As the learner moves from piece to piece within a program, a standard format is the primary element of continuity and structure. Once the learner has internalized the structure, he or she can move securely within the system with certain expectations. This helps the learner to deal with the material more easily and to spend the learning energy on the content of the program rather than on its trappings.

For the prototype a task should be selected from the task analysis that seems to be repre-

TABLE 10

MEDIA MATRIX WORKSHEET

TASK:	Demonstration/field trips/experiments	Discussion	Computers/ teaching machines	Printed materials	Still visuals	Audio/ still visuals	Audio recording	Motion pictures, videotape, film, etc.	Objects/ models/prototypes	Simulation	Games	Lecture	On-the-job training
1. Appropriateness													
2. Quality													
3. Availability/ Accessibility													
4. Cost													
Media Selection													

sentative of the majority of tasks to be covered. The prototype shouldn't be cut in stone regardless of what comes up; however, it is best to deal with as many types of problems as possible at the outset.

A systematic written presentation of guidelines for development carries out all the functions of the prototype and supports the prototype. Many times it is tempting to let simple verbal agreement and developer memory substitute for written guidelines. However, the time taken to write the guidelines is more than reimbursed by time saved in development, quality control, and the correction of changes.

The guidelines are most useful if they are directly linked to the prototype. The guidelines should match the prototype part by part with the "why" and "how to" information (i.e., why is it important to write it in this way, what does it accomplish and how should it be stated). If the guidelines for development are written in an outline format, the outline number (IIb2 for example) can be transferred to the margin of the prototype at the relevant point so that the example of what is being discussed is referenced. For this reason, the guidelines should be developed concurrently with the prototype module.

The guidelines should cover the following concerns:

1. General principles that apply to the program as a whole such as—
   - target reading level and
   - pattern of instruction (e.g., explain how to do it, show them how to do it, prompt them to practice it).
2. Component parts of the module. For example, the parts of a competency-based module might be as follows:
   - Title and structural reference
   - Performance objective and any enabling objectives
   - Introduction
   - Materials
   - Glossary (optional)
   - Body of the module: text, graphics
   - Information sheets or data sheets
   - Worksheets or activity instructions
   - Answer keys (optional)
   - Performance checklist
3. Use of graphics.
4. Readability considerations.
5. Editorial/format considerations (including style conventions).
6. Any material that is to be standard.
7. Special considerations such as the following:
   - How information for special populations is to be handled
   - How basic skills information is to be dealt with—
     —Are the basic skills to be taught as part of the task?
     —Are special basic skills modules to be provided?
     —Are special remediation arrangements to be made?

Having all these decisions written down is important for developers—it frees their intellect for thinking, not keeping guideline decisions in mind (although in practice, after a period of time, the whole thing becomes second nature).

Schedule the Development Effort

One of the helpful aspects of meeting all the prerequisites to development is that the development task is so well specified that it becomes possible to schedule the instructional materials development with some degree of confidence. It should be taken into account that instructional

materials development is far more time-consuming than most people estimate it to be—especially if the standards are high. To get an estimate, the person who developed the prototype should time the development of a second module and then add at least 25% of the time for individual and module variation.

The schedule should state who will do what, in what sequence, and when. The schedule should include production of the materials if that is seen as part of the project effort; that involves a number of support people for the developers (e.g., word processors, media and graphics specialists).

A good point to keep in mind when searching for ways to compress the schedule is that shortcuts should not be made at the price of quality in materials development. Both students and teachers will be using the materials for a long time.

⑩ DEVELOP MATERIALS

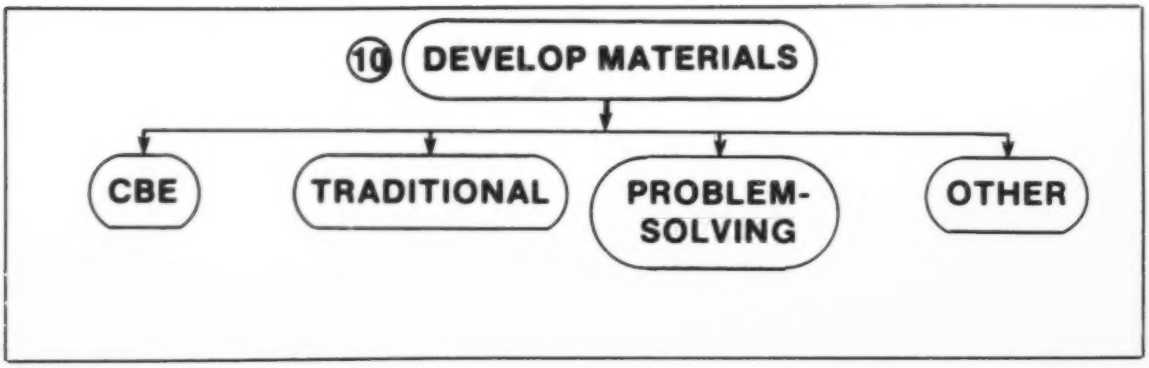
When all nine prerequisites to instructional materials development have been completed, development can proceed relatively easily because of the firm foundation that has been laid. The following list reviews the steps that have been taken:

- The training needs have been identified.
- The job for training has been described so that the scope of the training is defined.
- The job has been analyzed so that all relevant tasks are identified.
- The tasks on which classroom training is necessary have been selected.
- The tasks for instruction have been analyzed to a level of detail suitable for the instructional program.
- The occupational tasks have been cross-correlated with the academic skills needed to perform them.
- The desired instructional system has been selected.
- The scope of the project has been identified as new development, adaptation, updating, or supplementing of materials.
- The development task has been specified through a prototype, guidelines for development, and a schedule.

These nine steps comprise a major amount of the effort required to reach the final outcome of developed materials to place in the hands of students. It is important in following the steps of this systematic approach for instructional materials development never to lose sight of that ultimate goal of effective materials for student instruction.

The next step is to develop the materials themselves. Because the nature of the development step differs with the mode selected, information about development in each of the three modes is provided separately. The next three chapters present the three modes previously discussed:

- Competency-based individualized instruction
- Applied learning in a problem-solving mode
- Lesson plans for traditional instruction


10
DEVELOP MATERIALS
CBE
TRADITIONAL
PROBLEM-SOLVING
OTHER

Develop Competency-Based Instructional Materials

Competency-based instructional materials are based on a particular educational philosophy. The characteristics of this type of materials reflect this philosophy.

Rationale

Vocational educators need to respond to challenges of business and industry by preparing students who are equipped to handle the demands of jobs in today's world. The need to certify students as competent in certain job skills has led to wide and growing acceptance of a competency-based form of education.

The Challenges for Vocational Educators

Traditionally, vocational educators have been faced with the challenges of preparing students with entry-level job skills, assessing manpower needs, and responding to technological advances and social trends. Vocational educators must determine the criteria for successful performance of specific job skills and must know when and how to assess those skills effectively.

Thus, it is important for vocational educators to determine in exactly what skills students should be trained and to utilize a system for updating this information. If, for example, the job skills of the animal technician or the building maintenance supervisor are changing, vocational teachers need to prepare students for the new skills they need. This information must be collected and integrated into the existing curriculum.

It is also necessary for vocational teachers to know how labor needs in certain occupations will vary. Programs must adjust to meet these labor requirements. In order to meet the challenges effectively, vocational educators have need of a systematic and flexible instructional approach that can address the changing skills required of workers. This instructional system must be responsive to different learning characteristics and learning styles of students and be able to incorporate a variety of teaching strategies. It must spell out the performance requirements in the form of objectives and must provide directions which help lead the student toward *competency* or successfully demonstrated performance of job tasks.

Learning as a Constant

In education, often learning has been accepted as the variable and *time* the constant. Whenever it is said that a course involves a specific number of hours of instruction, acceptance of this historical approach to education is demonstrated. A set number of hours per course is partly an administrative and planning convenience. However, under these circumstances, teaching is often geared to covering as much information as possible in the time permitted, in hopes that enough will be learned to allow students to be successful.

SOURCE: Much of the material presented here is adapted from *Curriculum Developer's Resource Guide* developed by the National Center for Research in Vocational Education for the Alliance for Career and Vocational Education.

Many persons feel that teachers involved in vocational education should be opting to implement programs in which learning is the constant and time the variable. Vocational educators in many states are currently working to make this option a reality in their vocational education programs through the implementation of competency-based education (CBE).

A central idea is that a course of study satisfy each student's particular personal and vocational needs. The strategies or techniques that best fit individual learning characteristics and styles should be a primary concern. However, teachers often find this difficult to put into practice. Suppose that the instructor knows exactly what ought to be taught to prepare each student in an occupation. How does the instructor teach each student in a way he/she will learn best? A student who has good visual learning ability (learning through pictorial or visual instruction) may not be successful when given a large amount of printed material or verbal instruction. That student may benefit from a variety of well-chosen filmstrips or slides to enhance his/her learning strengths. Similarly, a student who learns better from having a skill or concept demonstrated will require more demonstration for successful training. Some students will learn more effectively if they can have time to read and review written learning material. Furthermore, some students may need cooperative tutoring arrangements to enhance their learning. As each type of student selects vocational education, the vocational teacher must be prepared to offer a variety of learning alternatives in a self-paced system.

Competency-based education (CBE) is one answer to these needs. CBE is a flexible, systematic approach in which students work at their own pace in an individualized program. Using a sequence of performance objectives and learning experiences or activities, students work toward successful performance of occupational tasks which signify a level of competency in those tasks. Their performance is evaluated on the basis of criteria stated in the performance objectives.

Characteristics of CBE

The usual characteristics of a competency-based vocational instruction program are as follows:

- **The CBE program is based upon employer verified competencies needed by entry-level workers in specific occupations.**

- **Students know what their own learning objectives are before they start using their instructional materials.** Performance objectives let the student know the skills that will be learned and the criteria that will be used to determine whether mastery has been achieved.

- **The student's learning process and instructional materials are individualized.** The student's program is self-paced within reason. Learning activities are tailored to meet individual learning styles and characteristics. Students are provided with simulated situations in order to practice and demonstrate their skills in an occupational setting.

- **The student participates in planned supplementary activities and uses resources designed to reinforce the learning activities.** The student does not work alone all the time and frequently participates in demonstrations, group activities, and so forth.

- **The instructional program is designed to provide immediate evaluation and feedback after each learning experience.** Specific, criterion-referenced evaluation devices are used to assess the student's progress and performance.

- **The operational units are generally self-contained and include all of the information essential to accomplish the expected performance.** Occasionally, outside references are required when the student can best obtain the information from the original source or when the reference is considered to be a standard by practitioners in the occupation.

- **Assessment of the student's performance is used as the primary source of evidence for determining entry-level competency.** Objective evaluations of the student's knowledge, skills, performance, and attitudes are completed prior to certifying the student as competent to perform entry-level tasks within the given occupation.

- **The teacher's and student's roles change.** The teacher is a manager or "facilitator" of instruction rather than a dispenser of information or lecturer. The teacher evaluates a student's performance when that student is ready to demonstrate mastery. The student is involved in planning the program, seeking help when needed, and maintaining awareness of progress.

Identify Performance Objectives

A characteristic feature of competency-based education is the use of modules. A module is a type of learning package that usually includes a terminal performance objective, enabling objectives, essential cognitive information, and criterion-referenced evaluation. While modules are developed in a wide variety of formats, most are self-contained, transportable, and designed for individual use. Performance objectives may be, and are, used in many types of instructional materials. Because they are essential to competency-based materials, they are discussed here.

A *performance objective* is the instructional description of a task. It describes briefly what students are to be able to do when they have completed the module and are ready to demonstrate the particular task. For a chef in training, the performance objective of a task might be:

> Given a simulated situation, prepare three menus each for luncheons and dinners. Your completed menus must meet the criteria on the performance checklist.

A formal definition of a performance objective is as follows:

> **Performance Objective**—A statement describing desired student performance, the conditions under which the performance is to occur, and the criteria by which the performance will be evaluated. The student is expected to be able to *do* something, rather than to simply *know* something. Thus, while knowledge is required in order to perform correctly, emphasis is placed on observable behavior. Performance objectives clarify the learning outcomes expected of the student and reflect the learning goals expressed in terms of the desired results of instruction.

Performance objectives are developed directly from the task analysis. A performance objective may be written for an entire task or for each operation. A good "rule of thumb" is that the more complex the task and related skills, the more performance objectives and modules will be required.

A performance objective consists of three parts:

conditions

performance

criteria

usually in this order. In developing performance objectives, it is helpful to formulate the performance part first and thus focus on it as primary. The three parts of the performance objective are pointed out on the sample performance objective worksheet (table 11) that follows.

Performance

The performance part of the objective describes the specific learning outcome as the terminal behavior to be demonstrated by the student when he or she has achieved the objective. Only one behavior should be included in a performance objective. The feeling that more than one verb is necessary is often an indication that a task should be broken down further.

TABLE 11

SAMPLE PERFORMANCE OBJECTIVE WORKSHEET

Occupation: Legal/Medical Secretary Competency No. 1.0 Task No. 1.01

Performance Objectives

Operation	What is needed to complete the task? (Required)	What behavior will the learner perform? (Desired skill or sub-skill)	How well must it be performed? (Criteria)
1.01A	Given a rough draft or straight copy . . .	the learner will be able to determine the proper format to type from rough draft or straight copy . . .	according to standard format specifications.
1.01B	Given a rough draft or straight copy and a dictionary . . .	the learner will scan and proofread the rough draft or straight copy, marking needed corrections . . .	with at least 90% accuracy.

The performance must describe student behavior rather than teacher behavior and should specify knowledge, skills, or attitudes. A behavior should not specify what an individual is doing to or for another individual. An example of behavior stated in an undesirable way is:

> In a communications course, the teacher will help the student to complete job applications.

In each performance objective, "the student will be able to . . ." can be used as a stem to focus the objective on student behavior.

The performance may be categorized into three major types:

- **Psychomotor**: emphasis is on physical skills and dexterity.
- **Cognitive**: emphasis is on knowing, conceptualizing, comprehending, applying, synthesizing, and evaluating.
- **Affective**: emphasis is on attitudes, values, and emotions.

For competency-based education, psychomotor and cognitive objectives are the aim, and the particular language used in stating the objective is critical. (This doesn't mean that the affective area is not important, simply that it can often be embodied in the materials in other ways.) Most authors pay special attention to the verb in the statement of an objective. Such non-observable verbs as "think," "appreciate," and "know" are considered unacceptable. However, specific, observable action verbs such as "write," "assemble," and "state" are highly acceptable. Lists of such verbs for the different categories have been put together. One such commonly used list is included on the next three pages as figures 3 through 5.

A test to see if an objective is written in performance terms is the question, "Can I *see* or *hear* the actor performing this task?" If the answer is no, then the objective is not written in performance terms.

Conditions

The conditions part of the objective identifies the limits and circumstances under which the student will perform the behavior. This includes specifying the tools, job aids, and references that the students will use as well as the setting in which they will perform. These should be identical to the test situation. The purpose here is to clarify the objective; therefore, some consider this part optional if no clarification is required.

Much of the information for the conditions part comes from the tools and materials section of the task analysis. Specific subject matter should not be listed, although reference resources containing that subject matter might be listed. The conditions should be clearly feasible for the classroom. If elements of the work environment cannot be easily duplicated in the classroom, an instructional substitute must be made.

Criteria

The criteria set minimum standards that the student must meet to be certified by the teacher as having attained competency. If these standards appear on the task analysis, it is a matter of incorporating those in the performance objectives.

How well students are expected to perform may be stated in different ways depending on the nature of the task. Several examples follow:

- **Accuracy.** States the minimum number (such as nine out of ten), percentage (such as 70 percent), proportion (such as 3/4), of correct responses needed to be successful.

  When numbers are used to specify degree of success, they should not be set arbitrarily. There should always be a logical rationale for stating the minimum number of items that must be included.

  Perfection can also be specified; consider the level that realistically represents the

These verbs can be used to describe manipulative skills that are most directly related to vocational job skills.

activates
adjusts
aligns
assembles
builds
calibrates
changes
cleans
composes
connects
constructs
corrects
creates
designs
disassembles
disconnects
dismantles
draws
drills
fastens
fixes
follows
grinds
grips
hammers
heats
hooks
identifies
locates
makes
manipulates
mends
mixes
nails
paints
sands
saws
sharpens
sets
sews
sketches
starts
stirs
turns off
turns on
type
uses
weighs
wraps

Figure 3. Verbs for psychomotor domain

job performance (map reading - no serious risk; medical - few errors acceptable). How important is the correct performance? How critical is information to performance? Would there be time to look it up on a job? (Perfect = 100% accuracy.)

- **Speed.** Set time limits. How well a student must do to be successful may be stated, in some cases, by setting a time limit. For instance, a student may be asked to "type a 200-word passage within 3 minutes." This objective measures the time it takes a student to accomplish the task because in typing, speed is important. Time limits also can be set to measure duration. For instance, "Students will hold a part-time job for at least 3 months."

- **Qualitative requirements.** State those items that must be included in the response in order for the response to be correct. Then, no matter how else or how much the student responds, he/she cannot be successful unless the required items are included in the response.

A phrase may be used to tie the standards to detailed criteria (usually the criterion-referenced test). Phrases such as:

"That meets predetermined standards"
"That meets established criteria"
"At an acceptable performance level"

should be used only if you also state where to find the specifics.

These verbs can be used to describe intellectual outcomes such as knowledge, understanding, or thinking skills.

KNOWLEDGE

defines
describes
identifies
labels
lists
matches
names
outlines
reproduces
selects
states

COMPREHENSION

converts
defends
distinguishes
estimates
exemplifies
explains
extends
generalizes
gives
infers
paraphrases
predicts
rewrites
summarizes

APPLICATION

changes
computes
demonstrates
discovers
manipulates
modifies
operates
predicts
prepares
produces
relates
shows
solves
uses

ANALYSIS

breaks down
diagrams
differentiates
discriminates
distinguishes
identifies
illustrates
infers
outlines
points out
relates
selects
separates
subdivides

SYNTHESIS

associates
categorizes
combines
compiles
composes
creates
devises
designs
explains
generates
modifies
organizes
plans
rearranges
reconstructs
relates
reorganizes
revises
rewrites
summarizes
tells
writes

EVALUATION

appraises
compares
concludes
contrasts
criticizes
discriminates
explains
interprets
justifies
relates
summarizes
supports

Figure 4. Verbs for cognitive domain.

These verbs can be used to emphasize feelings and emotion, such as interests, attitudes, appreciation, and other values an individual internalizes.

RECEIVING

asks
chooses
describes
follows
gives
holds
identifies
locates
names
points to
selects
sets erect
replies
uses

RESPONDING

answers
assists
complies
conforms
discusses
greets
helps
labels
performs
practices
presents
reads
recites
reports
selects
tells
writes

VALUING

completes
describes
differentiates
explains
forms
initiates
invites
joins
justifies
proposes
reads
reports
selects
shares
studies
works

ORGANIZATION

adheres
alters
arranges
combines
compares
completes
defends
explains
identifies
integrates
modifies
orders
organizes
synthesizes

VALUE COMPLEX

acts
discriminates
displays
influences
listens
modifies
performs
proposes
qualifies
questions
revises
serves
solves
uses
verifies

Figure 5. Verbs for affective domain

The chart in table 12 summarizes the foregoing information for quick reference.

Enabling objectives.

Students may need to have certain knowledge, skills, and attitudes before an objective can be achieved. Therefore, a distinction is often made between terminal objectives and enabling objectives.

An enabling objective is one of the several process-type objectives that help students progress toward achievement of a terminal objective. These are designed to help (or "enable") the student to learn the target occupational skill. They break the learning into a few major elements, making it easier and more efficient for the student to master each part. Students who are learning to be chefs might work on two enabling objectives that will help them learn how to prepare menus:

> After completing the required reading, demonstrate knowledge of the nutritional aspects of menu preparation. Given a case situation, prepare a hypothetical luncheon menu. Your instructor will critique your completed menu, using the luncheon menu checklist as a basis for the critique.

Guidelines on enabling objectives include the following:

- Enablers are designed to help students achieve the competency. They are not ends in themselves. If any enabler won't really help students learn it should be changed or deleted.
- The main section of the enabling objective begins with an action verb, just like a competency statement or objective. The statement should be short and concise.
- A "conditions" element may be included at the beginning of an enabler. This may specify the resource given to the learner, the limitations imposed, or the setting in which it is to take place, as in the following examples:
  - After completing the required reading . . .
  - Without the aid of references . . .
  - In the clinical setting . . .
  - Given a set of data . . .
  - On a practice engine in the laboratory . . .
  - For an actual customer . . .
- Some performance enablers that help students learn the components of the occupational competencies are (1) the knowledge component (e.g. "Define important terms related to respiratory disease."), (2) the practice component (e.g. "Give a shampoo to a fellow student."), or (3) the attitudinal component (e.g. "In a given case study of a salesperson handling a customer's complaint, describe how the salesperson's attitudes affected the situation.").

Identify Criterion-Referenced Measures

The evaluation procedures used in competency-based vocational instruction use criterion-referenced measurements which are based on predetermined job standards or criteria. Contrasted with norm-referenced measurement, which provides information concerning the student's performance compared to that of other students on the same measure, criterion-referenced measurement provides the teacher with information concerning specific skills a student does or does not have. Used as a tool for obtaining meaningful and reliable information, criterion-referenced measurement is particularly suited to use with CBE programs.

A *criterion-referenced measure* is defined as the standards, established in advance of instruction, that will be used for assessing the learners' development of the skill, knowledge, and/or attitude as stated in the performance objective. The standards are based on actual occupational standards and do not involve measuring the performance of one student against the performance of other students.

Specific criteria guidelines are used by the instructor for assessing competency. The instructor certifies the competency by signing the performance or evaluation checklist.

TABLE 12

HOW TO WRITE PERFORMANCE OBJECTIVES

Parts of an Objective	How to Write an Objective	Characteristics
1. **Performance** Gives a clear statement of exactly what the learner will be able to do	**Specify what the learner does** Use action verbs that are measurable, observable, verifiable, reliable (not subject to different interpretations).	**"Must Do"** Physical activity, requiring movement of some muscles of the body or Directly observable **"Must Know"** is also involved (information necessary for successful job performance, such as name, labels, facts, etc.) along with the skills of thinking, creating, and analyzing, but these are not stated.
2. **Conditions** Identifies all limits or circumstances under which the learner will perform the objective	**Specify what the learner is given** List the job aids, equipment, technical references, special tools, environmental conditions, special instructions, signals, symbols, problem situations, or contingencies.	**Resources the learner is given** E.g., a recipe; a set of drawings; a formula; etc. **Environmental conditions** E.g., with background noise; in a shop setting; outdoors in rainy weather, without supervision; etc.
3. **Criteria** Sets minimum standards the learner must meet	**Specify the outcome and how well it is done** Provide a complete description of (1) the procedure or product desired and (2) criteria for its acceptability	**Precise nature of the output** E.g., number of features; number of steps, points, pieces, etc.; what must be covered or produced; acceptable portion of total; exact numbers reflecting tolerance; values or dimensions that acceptable answers/performance can assume **How well** 1. Accuracy 2. Speed 3. Qualitative requirements

This type of evaluation has several functions for the student:

- It provides advance knowledge (in a highly specific breakdown) of what the student will be asked to do.

- It provides a pretest as well as a posttest. It provides the opportunity for students to "test out" of modules covering skills they already have and spend their time instead on skills they need to learn. If this option is not available, the use of the evaluation as a pretest still points out the areas in which the most work is necessary.

- It provides a self-check of progress in skill development before the student asks to be evaluated.

- It identifies skills that have not been attained and for which additional time/remediation may be necessary.

- It forms an organized, comprehensive, and highly specific competency record for the student to share with potential employers as evidence of certified skills.

Criterion-referenced measures are often listed on a performance or evaluation checklist, defined as follows:

> **Performance or Evaluation Checklist**—A list of specific criteria, usually based on actual occupational standards, that is used to evaluate the process used and/or product developed by a worker when performing an occupational skill. This checklist serves as a guide to the evaluation process. There should be an evaluation checklist for each performance objective. The checklist should correspond item by item with the steps in the task analysis as they are covered in the instructional materials. Furthermore, the checklist should, in its totality, bear a close resemblance to the performance objective. In fact, much of what has already been discussed regarding the rules for writing performance objectives applies equally to writing criterion-referenced test (CRT) items.
>
> When developing criterion-referenced measurements, the teacher/developer should be concerned with learner performance in the three learning domains (or levels) discussed earlier: cognitive, affective, and psychomotor. Evaluation in the cognitive domain emphasizes learner knowledge, recall, comprehension, recognition, and analysis. The affective evaluation deals with learner interests, attitudes, and values. The psychomotor domain deals with learner's manipulative skills and motor-centered activities. Each domain introduces different considerations into the evaluation process. The checklist as a measuring tool is applicable to all three learning domains as shown in table 13.

Different forms of measurement within a task can be included in a checklist. One format for the checklist is shown in figure 6.

The following general guidelines govern the writing of CRT items:

1. Write each item in clear, simple terms so that the learner understands what is expected.

2. List any items that are critical to skill development; avoid listing minor points that are common knowledge.

3. Sequence the items in the order that the learner's performance will be evaluated.

The traditional view on development of CRT items is that they should be developed along with the performance objectives and in advance of module or learning package development. It is possible to do this, and this approach has the benefit of providing, along with the checklist, an outline for the learning module. However, this presumes an in-depth envisioning of how every step of the module will be worked out in a logical flow. This approach works out most easily in situations in which the CRT items are fairly general and the level of instruction is not very detailed. For detailed, complex, and highly technical and specific occupational training programs, some effort may be saved by writing the CRT items last. Writing the CRT items becomes an easy task when one simply needs to restate each step of the module, because what needs to be tested would have already been worked out in the module.

TABLE 13

CRITERION-REFERENCED EVALUATION

Learning Domain	Evaluation Emphasis	Measurement Method	Approaches to Evaluation
Cognitive	knowledge of facts, data, and related information necessary to perform a task	paper-pencil tests checklist	recognition items constructed response items
Affective	student attitudes, beliefs, feelings, and values	observation checklists rating scales interviews problem solving simulations oral exams questionnaires	receiving (attending) responding valuing organization characterization
Psychomotor	manipulative skills, ability to perform work-related tasks	checklist rating scale performance test	process product process and product combined

Occupation: Legal/Medical Secretary

TASK 1.12: Type Manuscript

OPERATION 1.12A: Type Manuscripts from Rough Draft in Acceptable Format

LEARNER CHECKLIST Did you:	Criteria	INSTRUCTOR CHECKLIST Did the learner:
☐	1. Follow the typing specifications for the journal?	☐
☐	2. Set equal margins on the typewriter?	☐
☐	3. Properly insert and position paper and carbon in typewriter?	☐
☐	4. Type the manuscript according to the journal specifications?	☐
☐	5. Type the page number at the top of each new page?	☐
☐	6. Correct all errors on each page before removing from the typewriter?	☐

Instructor _____

Date _____

Figure 6. Sample evaluation checklist

Guidelines for Module Development with a Sample Module

Development of the modules for the instructional programs is a natural outgrowth of, and is rendered far easier by, the painstaking work done on the prerequisites for development and the identification of the performance objectives and the evaluation measures.

The modules may incorporate a variety of instructional modes in teaching the tasks. (Selection of those modes may have taken place as discussed at an earlier stage or may need to happen at this module development stage.) The modules themselves are, in most CBE programs, simple printed materials that guide the students in how to achieve competence in a task. The modules may refer students to mediated or other kinds of activities.

The component parts of a typical CBE module are repeated here for convenience and emphasis.

- Title and structural reference
- Performance objective and any enabling objectives
- Introduction
- Materials
- Glossary (optional)
- Body of the module: text, graphics
- Information sheets or data sheets
- Worksheets or activity instructions
- Answer keys (optional)
- Performance checklist

Some tips on how to develop this type of module are given in appendix B. The tips are given in a competency-based format. Use of this format provides an introduction to the structure of a competency-based module. The module would be a part of a training program for the occupation of curriculum developer. This is followed in appendix C by a sample module of one operation in a task from a draftsperson program. The quality control checklist that is provided in appendix E was developed from the guidelines for development of a competency-based program of a highly technical nature; this may provide additional insight on how to develop competency-based modules.

Develop Materials for Applied Learning in a Problem-Solving Mode

Instructional materials can be developed with a focus on problem-solving as a means of applying academic concepts.

Rationale for the Design Concepts

The rationale for designing instructional materials in a problem-solving mode is grounded in two basic ideas: 1) that employers need workers who are able to solve problems on the job, and 2) that students learn more effectively if material is presented in a context that they see as relevant.

What Employers Require

If schools are to equip students to function successfully in the work world, they must pay attention to what employers require of their employees. They must structure employer-required skills into the curriculum in a conscious way.

The fact that employers are calling for employees with stronger basic skills is well known. What deserves some special emphasis is the consistent underlying message, supported by research, that isolated basic skills such as reading and computation are not sufficient; employees must be able to use basic skills to make decisions and to solve problems. Sticht and Mikulecky (1984) have compiled much research information from the field and report:

> A good deal of recent research has examined basic skills in the workplace. This research includes work done in the military, and work examining wide ranges of occupations and workplaces. . . . The findings in these studies indicate several trends. Most occupations require a high level of basic skills, although the applications of these skills may be diverse. The workplace requires not only the ability to read, write, and compute, but also the ability to use these skills in problem solving on the job. . . .
>
> The nature of work in the United States and other industrialized countries is changing. As new jobs are created and old jobs disappear, new levels and types of basic skills for employment are also created. Occupations requiring little or no basic skills abilities are rapidly disappearing, while newly created occupations require workers to use reading and writing and computation at a fairly high level of skill in the solving of daily problems on the job. It appears likely that, in relation to job performance, it is considerably more important to apply basic skills in specific job situations than it is to demonstrate such skills on standardized tests. (pp. 4-7)

The idea that school studies tend not to include much practice in problem-solving is borne out by statements such as the following:

> The most critical issue facing educators today is students' lack of adequate thinking skills for solving problems and making decisions. Although research has shown that nearly all students beyond the age of 12 should be able to reason at the formal operational level, fewer than 40% of high school graduates are able to demonstrate higher-level thinking skills. This is not due to low intelligence but rather to students' inability to apply the higher-level skills and processes necessary for many curricular tasks. (Worsham and Stockton 1986, p. 7)

How Students Learn

Another cogent reason for developing materials for applied learning in a problem-solving mode relates to the notion of relevancy and motivation to learn. Learning researchers tend to agree on the idea that skills and knowledge are best learned if they are presented in a context that has meaning to the student and is therefore seen as relevant to the student's life. As stated by The National Commission on Secondary Vocational Education (1985),

> Work is as relevant to most adult Americans as death and taxes. Work is directly relevant to teenagers as a critical and necessary step to adulthood. Presenting subject matter in a form and manner that makes it more meaningful and significant to the learner is an aspect of quality. If a student cannot see the significance of the subject matter—cannot make sense of it—then that student cannot incorporate that subject matter into his or her own life and behavior. (p. 13)

Thus, presentation of academic material in an applied work context, which almost invariably means a decision-making or problem-solving context as well, can help all students to learn. The case is even stronger for those students who have trouble mastering abstract academic concepts. For those students, the application of the concepts to realistic, concrete problems and tasks may be critical to their learning the concepts at all.

The Joint Vocational-Academic Approach

In discussing the benefits of enhancing the applied nature or work-relatedness of instructional materials, it should be noted that this is precisely the area in which a joint effort of vocational and academic teachers can be most effective. One of the following statements is by a vocational educator, the other by an academic educator—in the final analysis, it would be best to say that they are both educators.

> Which stave in a barrel is most important? They all are. One of the concerns in the *Unfinished Agenda* was strengthening the ties between academic and vocational courses so that the academic learning could be applied in problem-solving situations and have greater utility in the workplace and life in general. These skills are interdependent, but this fact is too often overlooked. (Dr. Robert E. Taylor quoted in *Education and Employment: Where We Are and Where We Ought To Go 1985*, p. 33)

> One of the recommendations of the high school study commission was to strengthen the relationship between the academic and vocational offerings of schools and to view vocational programs as a way of strengthening the application of basic skills and problem solving. I think one of the ways that you develop problem-solving ability is, in fact, to solve problems. The applied learning of vocational classes is rich in problem-solving opportunities and reinforces problem-solving skills. (Dr. Harry F. Silberman quoted in *Education and Employment: Where We Are and Where We Ought To Go*, p. 33)

Characteristics of Materials for Applied Learning in a Problem-Solving Mode

For instructional materials to function in the desired way to apply learning in a problem-solving mode, the developer needs to be conscious of certain characteristics that should be built in as development proceeds. These characteristics include the following:

- Problem-solving and decision-making processes and competencies are embedded in the activities.
- Activities are participatory in nature and related to the real world and real consequences.
- Reinforcement of basic skills information needed in the situation is provided along with a suitable degree of guidance on how to proceed.

Problem-Solving and Decision-Making Processes and Competencies Are Embedded in the Activities

Complex thinking processes include problem solving and decision making. Although similar, the two processes differ somewhat. Problem solving uses thinking skills to resolve a known or defined difficulty. It involves several steps including:

- Identifying and defining the problem,
- Collecting data concerning the problem, separating fact from opinion,
- Forming hypotheses, through logical reasoning,
- Testing the hypotheses,
- Forming a conclusion,
- Applying the conclusion, and
- Evaluating the conclusion.

These steps are the same as the scientific method.

Decision making involves the thinking skills needed to choose the best response from several options. It entails the comparison of advantages and disadvantages of alternate approaches. It involves several steps including:

- Defining the problem,
- Collecting data,
- Identifying obstacles to the goal,
- Identifying alternatives, ranking alternatives, weighing risks and benefits,
- Choosing the best alternative
- Evaluating the decision.

Bloom's taxonomy of six thinking levels include: knowledge, comprehension, application, analysis, synthesis, and evaluation. Progression through these levels requires increasingly complex thinking skills in almost endless combinations. Persons who can apply a variety of thinking skills generally make better decisions and solve problems more effectively. Those who have skills that allow them to visualize the consequences of their decisions usually can make better decisions.*

Activities Are Participatory In Nature and Related to the Real World and Real Consequences

It was pointed out earlier that one of the ways to develop problem-solving ability is to solve problems. This implies that the students should assume responsibility for solving the problem in a given situation and should consider the consequences of their decisions.

*SOURCE: Adapted from Worsham and Stockton, 1986.

One of the most effective ways to ensure these characteristics is to use simulation techniques in the materials. A vocational simulation simplifies elements of a real world work situation and presents them in a form suitable for the classroom. Students take on the roles of people in the work situations. They are given conditions that are as realistic as possible and are asked to develop realistic solutions. The possible outcomes of their actions should be specified so that a tie to the consequences cements the relevance of the academics learned and used. Simulations can be designed for group interaction or for individual work.

Reinforcement of Basic Skills Information Needed in the Situation is Provided Along With a Suitable Degree of Guidance on How to Proceed

The materials can be organized around either academic concepts (and how they are applied vocationally) or vocational tasks (and the academic skills necessary to perform them). In either case it is important to be explicit about the academic subject matter to be used. Some targeted review of basic skills information can be implanted if necessary.

Depending on the situation and the problem-solving skills of the students, it may be helpful to provide some guidance on how to solve the problem. One option is to provide some analysis of the problem. A second option is to list the steps that need to be taken to solve the problem.

Some directions should be given, at a minimum to indicate the nature of the desired outcome. The directions can be made more detailed and more specific as the need dictates.

Guidelines for Development with a Model Activity

Appendix D shows an example of a problem-solving activity with accompanying development guidelines. This is only one of the many possible types of activities for applied learning in a problem-solving mode. It is a mini-simulation involving an individual student in a work role.

Develop Lesson Plans

A lesson plan is a detailed teaching/learning breakdown of the important points of a lesson arranged in the order in which they are to be presented. A lesson plan is a step-by-step analysis of how one intends to teach a lesson. If the preparation for instructional materials development is complete, the development of the lesson plan is mostly a matter of completing a form to show the planning and decisions already made.

Vocational and academic teachers can interact to produce lesson plans that will result in instruction emphasizing applied learning and the strengthening of basic skills. Vocational teachers can contribute ideas about occupational situations that can be used to illustrate the application of academic principles. Academic teachers can point out where in the vocational lesson plans the academic principles can be made more visible for students.

Why Develop Lesson Plans

One reason to commit these plans to paper is that the lesson plan acts as a summary and coordination device for the teacher. The teacher has all the details of the lesson gathered in one place and can visualize just what to do when class begins. This carries the thinking beyond knowing the material to using it to reach the objectives. The lesson plan allows for anticipation of problems and the opportunity to eliminate or overcome them in advance.

If the instructional method selected is an individualized self-paced mode, the lesson plan needs to allow for a wide range of activities and will involve more in the way of facilitation than details of presentation. If the instructional method is lecture, demonstration, or some other teacher-directed mode, the lesson plan will need to specify more closely exactly how the class time will be used for the group. Indeed, part of the function of the lesson plan is to assist in laying out how the objectives can be accomplished in the time available. The plans for a unit of instruction are broken down into daily plans that keep the teacher on track and working toward the overall goals in a time-conscious way.

In the classroom, the lesson plan serves as a handy guide. It is especially helpful for beginning teachers to have this kind of guidance for their instructional efforts. The fact that the lesson is well-planned and has been "captured" in a tangible way lends confidence to the teacher and even a sense of security to the students. The lesson clearly has a sense of purpose and direction.

Another practical reason for lesson plans to be written is that they enable a substitute teacher to carry on the program should the teacher need to be absent. The sense of security imparted by the lesson plan is even more appreciated by a

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SOURCE: The material presented here is adapted from *Develop a Lesson Plan, Module B-4* of *Performance-Based Teacher Education Modules* developed by The National Center for Research in Vocational Education and from *Training Development: Lesson Plan Derivation—Systems Approach (Samples)* by Tom L. Hindes, The Ohio State University.

substitute teacher who is thrown into the situation without warning or time for preparation.

Thus the lesson plan is helpful as a simply stated, clearly written, flexible and individualized teacher aid for conducting a class. It is individualized in two senses: (1) it is based on the individual needs, interests and abilities of the students; and (2) it is formatted according to the goals, needs, and style of the teacher.

Content and Format of Lesson Plans

Although lesson plans should be individualized by the teacher, it may be useful to discuss a sample that includes the characteristics that most teachers feel are needed. The lesson plan should include information about four stages: preparation, presentation, application, and evaluation. A sample of each of these parts will be shown and discussed. The combination of these parts constitutes the lesson plan. A blank copy of the form used follows the sample.

Preparation

The preparation section of the lesson plan gives the *lesson title* as primary identifying information. Some teachers may also want to include the course name, the unit title, and the hour or period the class meets.

A critical part of the preparation section is the listing of the *performance objectives* and any *enabling objectives*. These should have been identified earlier in the course planning and are rewritten on the lesson plan to serve as the targets for instruction.

Materials needed should be listed in one place so that they can be gathered together easily. The listing should be specific enough so that a substitute teacher would be able to identify the materials. For example, if a cassette tape is to be used, the list should specify the tape by title.

Other optional preparatory information may include—

- new words: a list of words that may require teacher explanation or review
- prerequisites: skills that students must have mastered for this lesson to be suitable
- references: sources of related information that the teacher may want to draw upon

An *introduction* concludes the preparation section (while introducing or leading into the presentation section). One major purpose of the introduction is to orient students to the objectives of the lesson, how the lesson relates to them, how it relates to their past classroom activities, and what will be expected of them. Two other functions of the introduction are to get the attention of the students and to motivate them sufficiently to hold their attention.

The following sample* (figure 7) shows how the parts of the preparation section may look.

Presentation

The presentation section of the lesson plan identifies the information or skill to be learned in a step-by-step list. Specific teaching strategies for a step, such as a demonstration or use of a videotape, should be noted as well. The strategies chosen may need to be detailed as well. For example, if a discussion is to take place, it may be helpful to prepare a list of questions to guide the discussion so that the desired information is elicited. Or a handout may be helpful to summarize key points or show an example.

Key points for the presentation can be listed alongside the steps as a handy reference. These may include basic skill concepts that should be drawn out and highlighted.

The presentation section from the same sample lesson plan is shown in figure 8.

*The sample lesson plan shown was developed by Tom L. Hindes of The Instructional Materials Laboratory at The Ohio State University.

PREPARATION

LESSON TITLE: MEASURING AND RECORDING THE PULSE

LESSON PERFORMANCE OBJECTIVE: Given a patient and a watch, the trainee will locate, count, record, and note the characteristics of the radial pulse. The pulse count and characteristics must be the same as what the instructor obtains.

ENABLING OBJECTIVES:

Define pulse rate
Explain the process which produces the pulse
List the factors that must be noted when observing pulse
Locate and name the points where pulse may be measured
Identify normal pulse rate ranges for infants and adults
Describe the pulse characteristics; rhythm, rate, quality
Correctly use the terms; tachycardia, bradycardia, arrhythmia, dysrhythmia, palpation
Differentiate between regular, irregular, full, weak, and thready pulses
List the factors that cause the pulse rate to vary
List the patient pulse information that must be reported to the receiving hospital
Describe the significance of pulse in the evaluation of an emergency patient

---

MATERIALS NEEDED: Stethoscopes, recording forms, tape recording of pulse sounds

---

NEW WORDS: Pulse, radial, rhythm, tachycardia, bradycardia, arrhythmia, dysrhythmia, palpation, artery

---

INTRODUCTION:

The EMT will record the patient's pulse rate, respirations, and blood pressure as part of the initial data gathering on the scene. These three factors reflect the functioning of the heart and lungs and provide information about the over-all cardiovascular and circulatory efficiency of the body. The pulse rate, respirations, and blood pressure (and sometimes the temperature) are termed vital signs or merely vitals. The accurate recording of these four values will provide important data for both field and hospital care.

The pulse rate is a reflection of the heart rate and is obtained by feeling the pulsation of an artery as its responds to the heart's pumping action.

Figure 7. Sample lesson plan

Note that the recording of data provides an opportunity to discuss technical communication and how to format the data effectively to convey meaning accurately. The mathematics of number series can be discussed as well. The entire task represents application of science principles.

PRESENTATION

STEPS:	KEY POINTS AND BASIC SKILLS FOCUS:
1. Define pulse	
2. Explain the process that produces the pulse	
3. Identify the pulse points	Temporal, facial, carotid, apical, brachial, radial, femoral, popliteal, posterior tibial, dorsalis pedia (communications)
4. Explain the purpose of measuring the pulse	
5. Explain and describe the factors that must be noted USE TAPE RECORDING OF SOUNDS	Rate, character, rhythm, quality, tachycardia, bradycardia, arrhythmia, disrhythmia, regular, irregular, full, weak, thready (science)
6. Identify normal pulse ranges	Infant—120 Adult—60 - 100 (math)
7. Identify and explain factors that cause the pulse to vary	Age, state of health, emotions, food, drugs, level of activity (science)
8. Explain the significance of the pulse	
9. Illustrate how to record the information	Format for recording data (communications)
10. Give demonstration	

Figure 8. Presentation section of a lesson plan

Application

The application section of the lesson plan states how the students are going to practice the skill or use the information. Enough detail should be included to ensure that the plans are carefully made for the activities to run smoothly.

In some cases it may be important to include a summary component at the end of the application section for (1) pulling the loose ends together, (2) drawing conclusions, (3) generalizing from the experiences, and/or (4) reiterating major concepts. By use of key questions requiring student responses, you can informally evaluate whether the lesson objectives have been met. Of primary importance is to relate all the classwork to the lesson objective(s) and to past and future lessons. In other words, the summary should reinforce for students where they were headed, where they have been, where they should be now and why, and where they will go from here.

The sample of the application section in figure 9 shows a situation in which the practice activities follow the presentation of the entire process to the class. This would not necessarily be the case. It might be useful to have the students practice one or more steps of a complex process before completing the presentation of the process. The divisions of the lesson plan should be used flexibly. For example, the last statement of the sample application section shows how the evaluation is being woven into the application.

Evaluation

The evaluation section of the lesson plan contains the assessments to determine if the students have reached the lesson objectives. This may involve a paper-and-pencil test for which the questions can be listed or attached. A performance check can be handled most effectively with the aid of a checklist and rating scale. If the performance situation and procedure is too lengthy to specify on the checklist, instructions for the performance check may need to be listed separately.

Portions of the sample evaluation section follow in figure 10.

Other Additions

Three other items need to be considered in planning a lesson: announcements, time, and notes.

APPLICATION

Divide the class into teams of two and have the teams practice locating pulse points on each other.

Each trainee must measure the pulse at the radial, brachial and carotid pulse points.

The trainees should listen to the tape recorded pulse sounds until they are able to differentiate between the various pulse sounds and characteristics.

The teams should use the stethoscopes to check each other for accuracy.

The instructor must be available for individual coaching.

Because each trainee must demonstrate competence in measuring the pulse and noting its characteristics, the instructor should begin to check off the trainees who have demonstrated this competence.

Figure 9. Application section of a lesson plan

EVALUATION

Paper and pencil test on the enabling objectives.

1. Pulse may be defined as:
   a. the flow of blood through the capillaries
   b. a wave of blood which passes along a vein
   c. the flow of blood through the heart as it pumps
   d. a wave of blood passing along an artery as the heart contracts

2. The normal pulse rate for an adult is:
   a. 40-60 beats per minute
   b. 40-80 beats per minute
   c. 60-75 beats per minute
   d. 60-100 beats per minute

3. To determine the rate of a person's pulse:
   a. count the pulse for 15 seconds and multiply by two
   b. count the pulse for 10 seconds and multiply by three
   c. if the pulse is regular, count the pulse for 15 seconds only
   d. if the pulse is regular, count the pulse for 30 seconds and multiply by two

4. The pulse rhythm is defined as the:
   a. rate
   b. volume
   c. strength
   d. regularity

5. A normal pulse volume will feel:
   a. rapid and weak
   b. slow and weak
   c. strong and full
   d. weak and thin

6. Arrange the steps for taking a radial pulse into the correct sequence:
   ___ a. Count and observe the pulse for 30 seconds to 1 minute
   ___ b. Relax the patient and explain what you are doing
   ___ c. Record pulse rate, rhythm, and time taken
   ___ d. Avoid too much pressure on the artery
   ___ e. Use the tips of three fingers and find the pulse.

7. A slow heart rate usually under 60 beats per minute is called:
   a. bradycardia
   b. tachycardia
   c. brainycardia
   d. pneumocardia

Practical test on the Lesson Performance Objective

TASKS:

1. Take and record victim's pulse.
2. Take and record victim's respirations.
3. Take and record victim's blood pressure.
4. Take and record victim's blood pressure by palpating the pulse.

(Depending on the type of instruction, these tasks might be followed by information on exactly what objectives, procedures, and standards apply to the practical test.)

Figure 10. Evaluation section of a lesson plan

PREPARATION

LESSON TITLE:

LESSON PERFORMANCE OBJECTIVE:

ENABLING OBJECTIVE:

MATERIALS NEEDED:

NEW WORDS:

INTRODUCTION:

PRESENTATION

STEPS:	KEY POINTS AND BASIC SKILLS FOCUS:

APPLICATION

EVALUATION

Figure 11. Lesson plan forms

Announcements are those items of business not related to the lesson content: a meeting of the student vocational organization, an assembly, the due date for independent study projects, etc. To make sure the item gets mentioned, and to make sure valuable class time isn't taken up with interruptions, any announcements should be written into the lesson plan, and scheduled for a particular time during the class period (i.e., during a break, at the very beginning, or at the very end).

It is especially valuable for the beginning teacher to indicate beside each activity in the lesson plan how much *time* the activity may take. Comparing the estimated time to the actual time used will allow a teacher to make more accurate estimates as time goes on. Time is a vital consideration. Nothing is more uncomfortable or less productive than 15 idle leftover minutes, or a lesson cut short prematurely. Good planning prevents these dilemmas from occurring.

Finally, a good plan should have a space for *notes*. This is another type of evaluative device, but this time it is the plan which is being evaluated. Immediately following the class period, this space can be used to write down any comments or questions relative to the plan and its effectiveness. What things worked? What things didn't work? What things didn't get covered? What questions were raised that need further clarification? How accurate were the time allotments for the various activities? These notes serve two purposes: (1) they can be generalized and thus help in writing other plans; and (2) should the same lesson be taught at a future date, these notes can suggest needed improvements.

Management of the Development Process

If the prerequisites to instructional materials development are all in place before the actual development process begins, managing the process becomes a matter of monitoring progress and controlling for quality.

Monitoring Progress

Whether the materials development project is a large or small one, careful monitoring and written progress records are essential to a productive and efficient operation. This is because the effort involves coordinating the work of several people and because it is impossible, even with careful scheduling, to predict how events will unfold. It is best to expect some delays, bottlenecks, and other problems—it is not abnormal for people to get sick, word processing equipment to develop quirks, or a particular module to be extra difficult to develop. If someone is aware of these situations, adjustments can be made before the problems compound and become serious.

The person who will monitor the flow of materials should develop a routing slip that shows, in turn, each person who will play a part in the processing of each module. Space should be provided for people to write their initials and the date as they complete their task and pass the module along. As a developer finishes a draft of a module, this routing slip should be stapled to the front of a folder containing the module. In this way, anyone can glance at the routing slip to find out where that module is in the process. A sample of such a routing slip follows in figure 12.

Additionally, there should be a wall chart or master log that compiles the information on the separate routing slips. A simple matrix chart is adequate, with the titles or a numbered coding of the modules down the side and the stages of processing across the top. It works well to have people write the date in the corresponding cell of the matrix as they transfer the module to the next person on the routing slip. This log provides a comprehensive view of the project's status and can be compared with the originally planned schedule. Each developer should also maintain a personal copy of this log as a status record of the modules for which he/she is responsible. Following in figure 13 is a sample log that corresponds to the sample routing slip.

Quality Control

Two aspects of the quality of instructional materials are of concern to those involved in their development. The first is how closely the finished materials correspond to the agreed-upon guidelines for development. This is a matter of internal (to the development project) quality control. The second is how well the materials meet the intended objectives in terms of student learning. That is a matter of external review (and ultimately pilot or field test evaluation). Both aspects are important, and the situation must dictate how much emphasis is placed on each.

MODULE TITLE & NUMBER _____

	Initials/Date	
Developer	_____	(Draft completed; give to Typist)
Typist	_____	(Give to QC)
QC	_____	(Give to Developer to revise OR give to Typist to correct)
Developer	_____	(Optional review)
Typist	_____	(Give to Developer)
Developer	_____	(Give to Graphics)
Graphics	_____	(Give to Developer for final check)
Developer	_____	(Give to Project Director for approval)
Project Director	_____	

Figure 12. Routing slip

Stages

Dev = Developer
Typ = Typist
QC = Quality control reviewer
Gr = Graphic artist
PD = Project director

Modules	Dev	Typ	QC	Dev	Typ	Dev	Gr	Dev	PD
1.0									
1.1									
1.2									
1.3									
2.0									
2.1									
2.2									
.									
.									
.									

Figure 13. Master log

Internal Quality Review

Internal review for quality control is simply taking the care to check on and enforce the following of the guidelines. The developer's role requires both an overall materials perspective and assiduous attention to a large number of details. It is to be expected, if one is realistic, that the materials that emerge from first draft development (and word processing) will be less than perfect. Yet the materials to be used by the student should be virtually perfect as measured by the cooperatively-established guidelines.

The person best qualified to bridge the "perfection gap" is someone who is very familiar with the guidelines for developing the materials but who is *not* familiar with the particular module or unit in question. This person can bring to the task not only an overall materials perspective and assiduous attention to a large number of details but also a "naive learner" status. A fresh viewpoint on the materials is gained, and the points in need of change are thereby made visible. If a developer must, of necessity, do quality control review of his/her own work, it is helpful to try to put the development involvement aside mentally and approach the review as objectively and "naively" as possible.

The quality control review is an important part of the materials development process. It provides an opportunity for the reviewer and the developer to work together to make the module student-ready.

Vocational and academic teachers who are involved together in an instructional materials development project can use this review point in the process to make sure that the materials meet the guidelines from both vocational and academic perspectives. If a vocational teacher has been the developer of an instructional module, an academic teacher can perform the quality review and at the same time be looking for possible improvements from the academic viewpoint. In the same way, a vocational teacher can review a module developed by an academic teacher and bring vocational insights to the review. The result should be materials of a truly vocational-academic nature.

For an extensive materials development project, it works well to assign one (or more) people exclusively to the quality control reviewer role. One person can better ensure consistency of approach across all modules and is in a position to identify gaps, overlaps, or conflicting information between modules. Furthermore, the skills required of a reviewer are not exactly the same as those required of the developer, so it may be more efficient to ask people to specialize in their areas of greatest strength. A logical mind, command of effective language use, and attention to detail are especially important for the person in the quality control role. An option in working out the processing flow is to ask an effective quality control reviewer to replace the developer in the final processing stages so the developer can concentrate on drafting more modules.

The guidelines for developers can be used as the quality controller's guide, but it is not time-consuming to follow the ideas from those guidelines and put together a quality controller's checklist. The purpose of this checklist is to make it easy for the reviewer to see if the guidelines have been followed. The fact that the checklist is developed from the guidelines provides common ground for the developers and quality control reviewers and paves the way for easy communication between them.

The example of a quality control checklist given in appendix E shows how guidelines for developers can be converted to a reviewer's checklist. It also shows the level of detail necessary to assure finished materials that follow the guidelines.

External Quality Review

It is usually helpful to seek the opinion of someone who is not caught up in the dynamic of the development project, who understands the needs of the students, and who is willing to provide a review of the materials. Ideally, the reviewer would be another teacher from the same vocational area, although not necessarily from the same school.

If the amount of material to be reviewed is large, a representative sampling of the modules can be reviewed. Then the developers don't feel as if they are imposing too much on colleagues' time.

As with internal reviews, directions and guidelines are necessary. Then the feedback will be structured in a way that is useful. Also, it is being considerate of the reviewers not to leave them guessing about what is asked of them. A checklist can guide their review as well as provide a vehicle for a time-efficient review. A sample external review checklist is shown as figure 14.

How well the instructional materials "work" will be proven ultimately with students in the classroom, perhaps first in a pilot test-revision cycle before full implementation. The entire instructional materials development process has been geared to this end, and it is important to evaluate objectively whether the materials help to achieve the desired goals with students.

Along with being sensitive to the possible need for revision after student use, it will be important on a continuing basis to be sensitive to the need to update or supplement the curriculum. The instructional materials may seem to be in constant flux, but they will remain a valid tool for promoting applied learning consistant with the occupational world.

MODULE QUALITY REVIEW CHECKLIST

MODULE TITLE: _____

MODULE NO.: _____ REVIEWED BY: _____

Language

1.	New terminology is defined in the introduction or information sheets.	YES	NO
2.	The terminology is consistent throughout.	YES	NO
3.	The internal directions are simply and clearly stated, and complete.	YES	NO
4.	The performance objectives are stated in observable terms.	YES	NO
5.	The procedures describe the options available to the learner in completing the module.	YES	NO
6.	The activities clarify what the performance is, how to do it, and why it is necessary.	YES	NO
7.	The language is lively and interesting; not mechanical or pedantic.	YES	NO
8.	The language is geared to the level of an average reader in the target audience.	YES	NO

Learning Experiences

1.	Learning experiences are sequenced logically.	YES	NO
2.	Learning experiences do not overlap.	YES	NO
3.	Learning experiences lead directly to competency in the performance objectives.	YES	NO
4.	All required readings contribute directly to attaining the objectives.	YES	NO
5.	All required activities contribute directly to attaining the objectives.	YES	NO
6.	When an activity may be difficult to implement, alternate ways of completing the activity are provided.	YES	NO
7.	Optional learning activities are provided to give depth, variety, and flexibility to the learning experiences.	YES	NO
8.	A range of activities is provided to accommodate students of different abilities, needs, and interests.	YES	NO
9.	A range of activities is provided to allow for both individual and group work.	YES	NO
10.	Role playing activities include role descriptions and situations to guide anyone playing a role outside his/her own frame of reference.	YES	NO
11.	The learning activities are varied and interesting, with a minimum of repetition from one learning experience to another.	YES	NO
12.	Feedback is provided at the end of every learning experience.	YES	NO

Information Sheets (Criteria in the "Language" section apply here.)

1.	The module is self-contained, if at all possible.	YES	NO
2.	Information sheets contain up-to-date and accurate information.	YES	NO
3.	Information sheets are concrete and tangible; not vague generalities or lists of criteria; they tell "how to do it."	YES	NO
4.	Information sheets are relevant to vocational education, with examples drawn from various service areas of vocational education.	YES	NO
5.	Selected pages of outside resources are used as enrichment and/or reinforcement activities.	YES	NO
6.	Outside resources are not more than 10 years old (unless they are of exceptional value).	YES	NO
7.	Readings (information sheets and outside references) are complete in that they provide the learner with all information needed to complete the module.	YES	NO
8.	Outside references are standard enough that they should be readily available to any module user.	YES	NO

Self-Checks, Model Answers, Checklists

1.	Self-checks are thought provoking and require application of information; not rote responses.	YES	NO
2.	Self-checks comprehensively reflect the information provided in the learning experience.	YES	NO

Figure 14. Module quality review checklist

3.	Self-checks are not obvious; they require an understanding of the knowledge important to achieving the competency.	YES	NO
4.	Model answers are provided to reinforce learning and clarify concepts.	YES	NO
5.	Checklists and assessment forms are stated in observable, performance terms.	YES	NO
6.	Checklists include all the criteria necessary for successful performance.	YES	NO
7.	Checklists actually assess the learner's progress toward the objective.	YES	NO
8.	Checklists are of reasonable length and complexity, with no more than 25-30 items.	YES	NO
9.	Alternatives to peer evaluation are provided for those learners who cannot arrange to work with peers.	YES	NO
10.	Each feedback device includes a stated level of performance.	YES	NO
11.	Evaluations provide for recycling if the level of performance is not met.	YES	NO

Media

1.	The media is applicable to all vocational service areas.	YES	NO
2.	The media illustrates, clarifies, reinforces, or extends the concepts introduced in the module; it doesn't simply repeat them.	YES	NO
3.	The media is realistec, i.e., the teacher, students, and real school setting are believable.	YES	NO
4.	The length of the media is reasonable (10 to 20 minutes).	YES	NO
5.	The media is interesting visually/aurally.	YES	NO
6.	The media is clear visually/aurally.	YES	NO
7.	If the media includes an exemplary instructor, the instructor:		
	a. relates well with students.	YES	NO
	b. uses student feedback.	YES	NO
	c. uses media or teaching aids where appropriate.	YES	NO
	d. presents information geared to the needs of the students.	YES	NO
	e. teaches on the basis of up-to-date learning theory.	YES	NO
8.	The media is free from racial and sex bias.	YES	NO
9.	The media is lively and action-oriented.	YES	NO
10.	The information is presented in a logical sequence.	YES	NO

Overall

1.	The module delivers on the objectives.	YES	NO
2.	The module meets format specifications.	YES	NO
3.	The module is internally consistent (objectives, activities, feedback devices, etc. do not contradict each other, directly or indirectly)	YES	NO
4.	No learning experience other than the final learning experience requires performance in an actual school situation.	YES	NO
5.	Opportunity is provided for practicing any performance which must be executed in the real world.	YES	NO
6.	The final learning experience requires performance in an actual school situation.	YES	NO
7.	The learning experiences are realistic; i.e., they do not require an unreasonable amount of prior knowledge or of time on the part of the learner.	YES	NO
8.	Implementation of the module is feasible and practical; i.e., it does not require an unreasonable amount of the resource person's time.	YES	NO
9.	Learning activities, information sheets, case studies, resources, etc. provide equitable representation of the various service areas in vocational education.	YES	NO
10.	An introductory statement is provided which motivates the student by explaining why the competency is needed, not simply what the competency consists of.	YES	NO
11.	An introductory statement is provided which places the module in a frame of reference with other modules in the category, and with the broad theory of vocational education.	YES	NO
12.	All necessary or desirable prerequisite competencies are listed.	YES	NO

Figure 14—*Continued*

Appendix A

A Checklist for Evaluating Materials for Sex Equity

A Checklist for Evaluating Materials

LANGUAGE

- Is the generic **he** used to include both males and females when sex is unspecified (e.g., the carpenter . . . he . . .)?
- Is the generic **she** used where the antecedent is stereotypically female (e.g., the housekeeper . . . she . . .)?
- Is a universal male term used when the word is meant to include both sexes (e.g., mankind, forefathers)?
- When referring to both sexes, does the male term consistently precede the female (e.g., he and she, the boys and girls)?
- Are occupational titles used with man as the suffix (e.g., chairman, businessman)?
- When a woman or man holds a non-traditional job, is there unnecessary focus on the person's sex? (e.g., the woman doctor, the male nurse)?
- Are non-parallel terms used in referring to males and females (e.g., Dr. Jones and his secretary, Ellen; Senator Kennedy and Mrs. Ghandi)?
- Are the words "women" and "female" replaced by pejorative or demanding synonyms (e.g., girls, fair sex, chicks, ladies)?
- Are women described in terms of their appearance or marital and family status while men are described in terms of accomplishments or titles (e.g., Senator Kennedy and Golda Meir, mother of two)?
- Are women presented as either dependent on, or subordinate to, men (e.g., John took his wife on a trip and let her play bingo)?
- Does a material use sex-fair language initially and then slip into the use of the generic he (e.g., A worker may have union dues deducted from his pay)?

Reprinted from: Women on Words and Images, *A Checklist for Evaluating Materials*, unpaged

- Is the issue of sexual equality diminished by lumping the problems of women, 51% of the population, with those of minorities (e.g., equal attention will be given to the rights of the handicapped, blacks and women)?

ROLES
occupational/
social

- Are all occupations presented as appropriate to qualified persons of either sex?
- Are certain jobs automatically associated with women and others associated with men (e.g., practical nurse, secretary--female; construction worker, plumber—male)?
- Are housekeeping and family responsibilities still a prime consideration for females in choosing and maintaining a career (e.g., flexible hours, proximity to home)?
- Is the wife presented as needing permission from her husband in order to work (e.g., higher income tax bracket)?
- Is it assumed that the boss, executive, professional, etc., will be male and the assistant, helpmate, "gal Friday" will be female?
- In addition to professional responsibilities, is it assumed that women will also have housekeeping tasks at their place of business (e.g., in an assembly plant with workers of both sexes, the females make the coffee)?
- Is tokenism apparent, an occasional reference to women or men in non-traditional jobs, while the greatest proportion of the material remains job stereotyped (e.g., one female plumber, one black woman electrician)?
- Are men and women portrayed as having sex-linked personality traits that influence their working abilities (e.g., the brusque foreman, the female bookkeeper's loving attention to detail)?
- Are only females shows as passive and inept?
- Are only females shown as lacking in desire to assume responsibility? (e.g., She was delighted to have risen to be "head secretary.")
- Are only females shown as emotional? (e.g., The secretary cried easily and was very thin-skinned.)
- Are only females presented as gossips?
- Are only women shown as vain and especially concerned with their appearance?
- Are only females presented as fearful and in need of protection? (e.g., She wasn't able to work late and walk home at night.)
- Are only males shown as capable, aggressive and always in charge?
- Are only males shown as brave and relentlessly strong?
- Do only males consistently display self-control and restraint?

- Are opportunities overlooked to present a range of emotional traits for females and males?
- Are women and men assigned the traditional roles of males as breadwinner and female as caretaker of home and children?
- Is a woman's marital status stated when it is irrelevant and when the same information about the man is not available (e.g., Mr. Clark and Mrs. Brown were co-workers.)
- In a family where both adults work is it assumed that females are responsible for indoor housekeeping chores and males are responsible for outdoor lawn and car chores?
- If a couple work together in a business is it assumed that she will assist **him** (e.g., Mary does bookkeeping and secretarial chores while Dan decides policy and attends to any heavy work.)?
- Is information included about family relationships which is not relevant to the task (e.g., Jane Dawson, mother of four, is the new supervisor)?
- Has the writer overlooked opportunities to present equality in occupational or social roles?

OMISSIONS

- Does the text deal with the increasing movement of both men and women into non-traditional occupations?
- In historical and biographical references are women adequately acknowledged for their achievements?
- Are quotes and anecdotes from women in history and from important living women used as frequently as those from men?
- Is there acknowledgment of the limitations placed on women in the past (e.g., Women couldn't attach their names to literature, music, inventions, etc.)?
- Are women identified by their husbands' names (e.g., Mme. Pierre Curie, Mrs. F. D. Roosevelt)?
- When a historical sexist situation is cited, is it qualified when appropriate as past history no longer accepted?

PHYSICAL APPEARANCE

- Are females described in terms of their physical appearance, and men in terms of accomplishment or character?
- Is grooming advice focused only on females and presented as a factor in being hired (e.g., advice to secretaries—"proper girdles to firm buttocks")?
- Is a smiling face considered advisable only for a woman in many occupations?
- Are only men presented or described in terms of accomplishment or character rather than appearance?

- Are only men presented as rarely concerned with clothing and hairstyle?
- Are men shown as taller and more vigorous, women as smaller and more fragile?
- Are women presented as more adroit with a typewriter than a saw?
- Are men presented as dextrous and at ease with tools and machines and baffled when confronted with a filing cabinet?

AUDIO/VISUAL MATERIALS

- Are male voices used consistently to narrate audio material?
- Are female voices used only when dealing with traditionally female occupations, such as child care?
- Do illustrations of males outnumber those of females?
- Do the illustrations represent mainly young, attractive and preferred-body types both in composite pictures as well as in the body of the material?
- Is the text inconsistent with the illustrations (e.g., a sex-fair text illustrated with sexist graphics)?
- Are the illustrations stereotyped (e.g., male mechanics and female teacher aides)?
- Are women shown caring for the home and children while men earn the income?
- When children are illustrated in role rehearsal, are their behaviors and aspirations stereotyped?
- Are women and men commonly drawn in stereotyped body postures and sizes with females shown as consistently smaller, overshadowed, or shown as background figures?
- Does the artist use pastel colors and fuzzy line definition when illustrating females and strong colors and bold lines for males?
- Are women frequently illustrated as the cliche dumb broad or child-woman?
- Are graphs and charts biased, using stereotyped stick figures?
- Are genderless drawings used in order to avoid making a statement or to appear to be sex-fair?
- Are bosses, executives and leaders pictured as males?
- Is only an occasional token woman pictured as a leader or in a nonstereotyped role?
- Has the illustrator missed opportunities to present sex-fair images?

Appendix B

Introduction to the Structure of a Competency-Based Module

Curriculum Developer

DUTY: Design the Program

TASK: Develop Competency-Based Modules

OPERATION: Develop Printed Materials for Competency-Based Modules

PERFORMANCE OBJECTIVE: The learner will be able to develop print-based materials for competency-based modules according to the guidelines in the evaluation checklist.

STEP 1. Gather the necessary materials:

Sample module
Task analysis
Paper
Pen

STEP 2. Establish a module format, using the sample module as a guide.

STEP 3. Establish module development guidelines, using the information sheet and the sample module as guides.

STEP 4. Select an operation from your task analysis.

STEP 5. Write a performance objective for the operation selected.

STEP 6. Prepare the title page for the printed module.

Procedure a. List the occupational title.
Procedure b. List the duty (number and) title.
Procedure c. List the task (number and) title.
Procedure d. List the operational unit (number and) title.

STEP 7. Develop the printed module. (Refer to the sample module as needed.)

Procedure a. On a blank page, write out the task number and title, the operational unit number and title, and the performance objective. Underscore this section of the page.

Procedure b. Begin content development with Step 1, by listing the materials, tools, and equipment necessary to complete the performance objective.

Procedure c. Next, starting with Step 2, direct the learner from the beginning of the operation to the end through the steps and procedures necessary to

perform the operation in a job setting (that is, the specific operation identified in the task analysis).

NOTE: Provide a small amount of information at a time. Major steps in the operation are translated into instructional *steps* in the module and procedures are translated into instructional *procedures* in the module.

Procedure d. Include safety notes to direct the learner's attention to possible hazards or special considerations while completing the job.

Procedure e. Include an expected outcome, when needed, for any step that includes three or more procedures, so the learner knows what has been accomplished.

Procedure f. If additional background information (theoretical or practical) is needed to help the learner perform the task, insert the words, "Read the information sheet," when and where it is needed.

Procedure g. Because the modules are self-instructional, provide small illustrations, when needed, next to a difficult step or procedure.

Procedure h. In the next-to-the-last step, (after the student has worked througn the module) include completion of the learner side of the evaluation checklist. Example, "Check your skills with the learner checklist. If you think you can complete this unit without aid or direction, see your instructor for evaluation. If you are in doubt about any part of this unit, repeat it."

Procedure i. In the last step in each module, direct the learner to prepare the work station for the next unit.

Outcome: You have developed a module.

STEP 8. Develop the information sheets as necessary to support the instructional activity. Information sheets should be clear, concise, and not overloaded with information. (See sample module.)

STEP 9. Develop worksheets as needed. (See sample module.)

Procedure a. Write the module number in the upper right corner.

Procedure b. Write "Worksheet" at the top of the page.

Procedure c. Write the body of the worksheet, using clear, concise language, directing the learner through the activity.

STEP 10. Develop the evaluation checklist if you have not already done so.

STEP 11. Proofread and correct all errors. Check to be sure material is legible.

STEP 12. Discuss your printed module with other curriculum developers and with the program coordinator.

STEP 13. When you are ready, check your skills with the evaluation checklist and proceed to the next module.

Information Sheet

Development of CBE modules requires that you bring together each of the operations from the task analysis and translate them into instructional units. A complete module consists of a title page, instructional content (giving the performance objective and steps and procedures), information sheet(s) (optional), worksheet(s) (optional), evaluation checklist, and support materials (optional).

Modules are the heart of the instructional program; they reflect the operations performed by a worker in order to complete an occupational task. Development of the modules calls for you to express each of the steps and procedures necessary for the student to accomplish the performance objective. Assuming that the student can read effectively, the student should be able to progress through each of the steps and procedures that have been enumerated. After completing the last content step, the student should be ready for the evaluation checklist.

The following techniques are used for making modules easier for students to read:

1. Keep sentences short, simple, and to the point.

2. Use the active voice when giving direction through steps and procedures:

   Active: Turn the switch off.
   Passive: The switch must be turned off.

3. Underline words for emphasis, but don't overdo it.

4. Use transition words when appropriate, such as "then," "now," "first," etc.

5. Use examples when necessary.

6. Always use accurate spelling and good grammar. Proofread and correct all errors.

An example of a complete competency-based instructional module follows in appendix C. Examine and complete the steps and procedures for this module as practice for writing competency-based modules.

Evaluation Checklist

TASK: Develop Competency-Based Modules

OPERATION: Develop Printed Materials for Competency-Based Modules

DEVELOPER CHECKLIST Did you:		PROGRAM COORDINATOR CHECKLIST Did the developer:
☐	1. Establish a module format and guidelines for development?	☐
☐	2. Prepare a title page for a module in the proper format?	☐
☐	3. Develop the printed page for a module in the proper format?	☐
☐	4. Develop the printed module according to the procedures in Step 7?	☐
☐	5. Develop worksheets as needed?	☐
☐	6. Develop the evaluation checklist?	☐
☐	7. Proofread and correct all errors?	☐
☐	8. Avoid plagiarism and violation of copyright laws?	☐
☐	9. Discuss your printed module with other curriculum developers and with the program coordinator?	☐
☐	10. Develop the ability to prepare printed CBE modules?	☐

Appendix C

Competency-Based Module Incorporating Basic Skills

Competency-Based Module
Incorporating Basic Skills

Occupation: Draftsperson

Competency: Apply Drafting Concepts

Task: Draw and Detail Objects

Operation: Draw a Primary Auxiliary View of a Symmetrical Object

Learning Activity

TASK:	Draw and Detail Objects
OPERATION:	Draw a Primary Auxiliary View of a Symmetrical Object
PERFORMANCE OBJECTIVE:	Given a drawing of a symmetrical object, the learner will be able to draw a primary auxiliary view in accordance with the evaluation checklist.

STEP 1. Gather the following items at your work station:

Worksheet
Drafting kit

STEP 2. Prepare to draw a primary auxiliary view of a symmetrical object.

Procedure a. Locate the front view of the first object shown on the worksheet.

Procedure b. Prepare to draw the auxiliary view of the object by reading the Basic Skills Information Sheet

Procedure c. Draw perpendicular projection lines along the line of sight to the angular portion of the object. The line of sight is the direction from which an object is viewed. (See figure A1.)

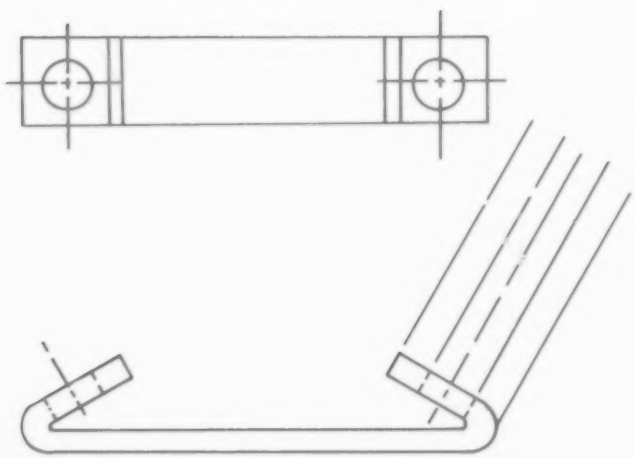


Figure A1

STEP 3. Establish a reference line.

Procedure a. Select a convenient distance from the object.

Procedure b. At this distance, draw a reference line perpendicular to the projection lines as shown in figure A2.

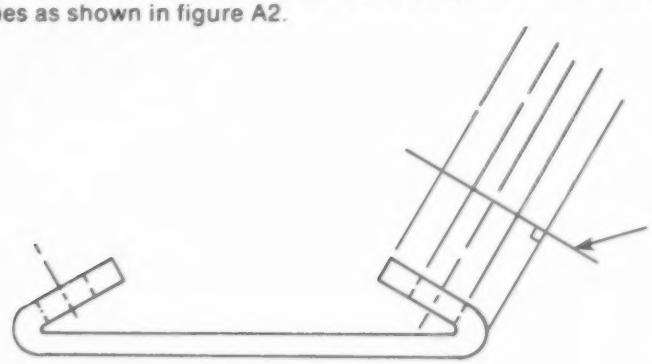


Figure A2

Outcome: You have drawn a line from which measurements can be taken.

STEP 4. Transfer measurements from the object to the auxiliary view.

Procedure a. Transfer the points which describe the dimensions of the object from the views on which they can be measured as shown in figure A3.

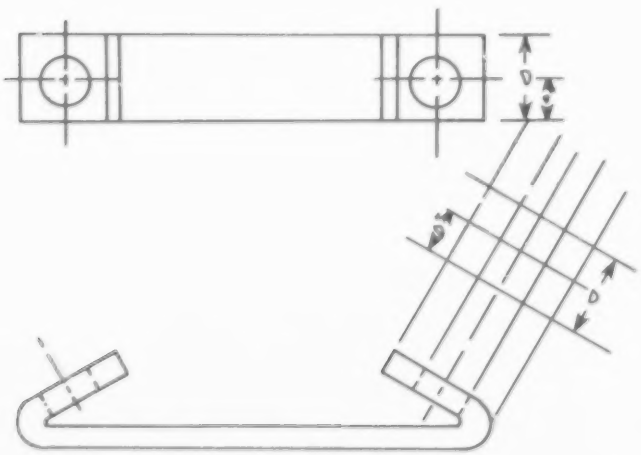


Figure A3

Procedure b. Connect the points that determine the shape of the object as shown in figure A4.

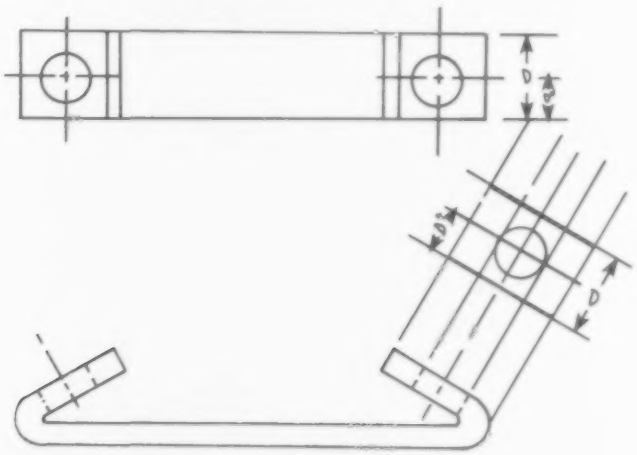
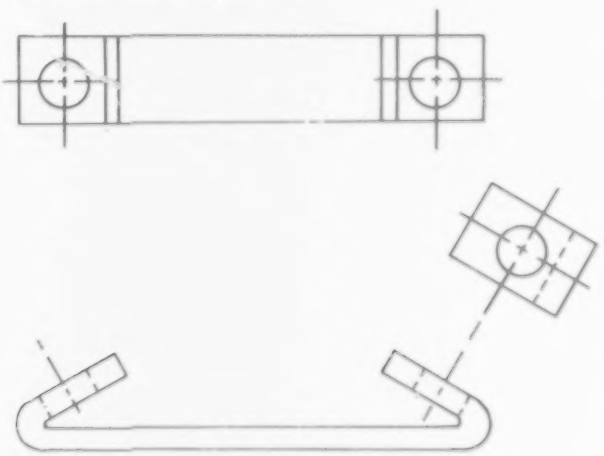


Figure A4

Outcome: You have transferred the measurements of the object to the auxiliary view and determined the shape of the object.

STEP 5. Darken all final lines as shown in figure A5.



Normal view of flange typical both sides

Figure A5

Outcome: You have drawn a primary auxiliary view of a symmetrical object, using one normal view for both flanges.

STEP 6. Check your skills with the learner checklist. If you think you can complete this unit without aid or direction, see your instructor for evaluation. If you had trouble with any part of this unit, repeat it.

STEP 7. Clean and store the equipment and material in preparation for the next unit.

BASIC SKILLS
INFORMATION SHEET

Many symmetrical objects with two angular surfaces can be described with one auxiliary view. One of the two angular surfaces must be projected and then drawn to represent the true shape of the angular surface. The auxiliary view should be given a note which reads, "This view typical for both angular flanges."

Projection lines are always drawn perpendicular to the surface being projected. Use the following procedure to draw a line perpendicular to a given line:

- Set your compass at any convenient radius.
- Draw an arc through line AB, with any point C as the center point as shown in figure A6.

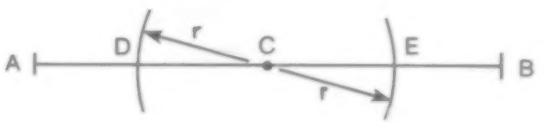


Figure A6.

- Label the points where the arcs intersect line AB with a "D" and "E" respectively, as shown in Figure 1.

Outcome: You have drawn an arc through line AB.

- Set compass at a distance greater than half the distance from point D to point E.
- Draw equal intersecting arcs from points D and E.

  - Draw an arc from point D above and below the line AB as shown in figure A7.

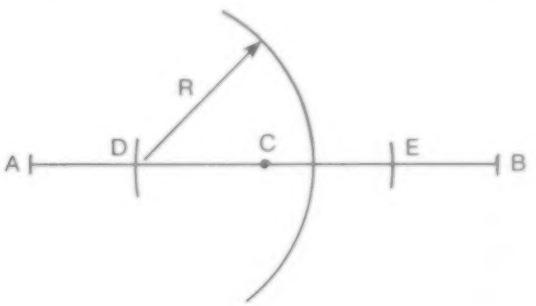


Figure A7.

  - Draw an arc from point E above and below line AB, and intersecting the arc drawn in Procedure a, as shown in figure A8.

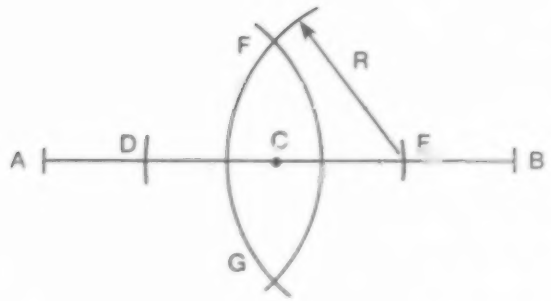


Figure A8.

- Label the points of intersection "F" and "G" respectively, as shown in figure A8.

Outcome: You have drawn equal intersecting arcs from points D and E.

- With your triangle, line up the two intersection points F and G and connect with a line as shown in figure A9.

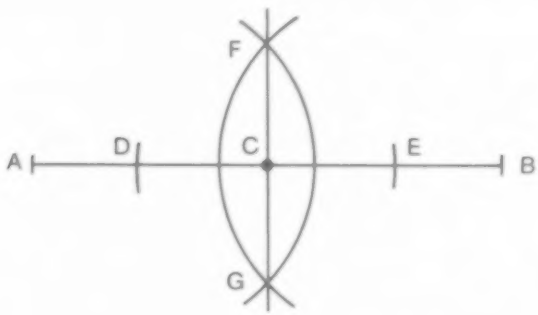


Figure A9.

Outcome: You have connected points F and G with a line that is perpendicular to line AB and intersects it at point C.

Evaluation Checklist

OCCUPATION: Draftsperson

TASK: Applying Drafting Concepts

OPERATION: Draw a Primary Auxiliary View of a Symmetrical Object

LEARNER CHECKLIST Did you:	Criteria	INSTRUCTOR CHECKLIST Did the learner:
☐	1. Prepare to draw a primary auxiliary view?	☐
☐	2. Establish a reference line?	☐
☐	3. Transfer measurements from the object to the auxiliary view?	☐
☐	4. Darken final lines and erase construction lines?	☐
☐	5. Repeat steps 2 through 5 for the other objects on the worksheet?	☐

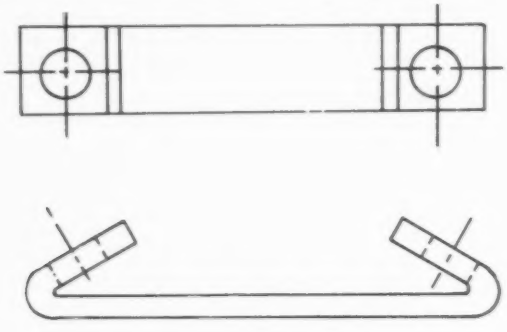
Instructor _____

Date _____

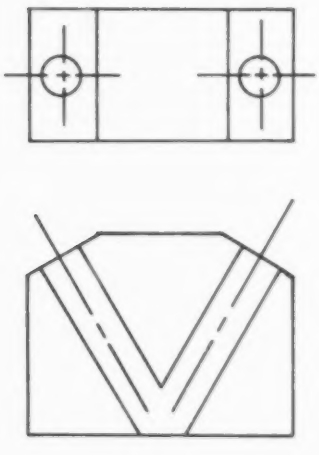
Worksheet

Project and draw a primary auxiliary view of the following objects:

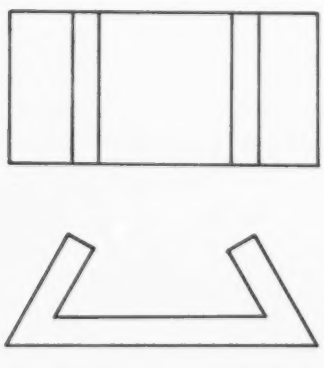
Object 1



Object 2



Object 3



Appendix D

Student Activity in a Problem-Solving Mode

Student Activity in a Problem-Solving Mode

TOPIC TO APPLY:
Sentences

HOW PEOPLE USE SENTENCES ON THE JOB:

- Nuclear engineers use sentences to convey very technical data in a meaningful way. They use sentences to write reports to be reviewed by people such as subcontractors, the Department of Energy, and the Nuclear Regulatory Commission.

- Playwrights use sentences to create dialogue between characters, given an outline of plot, staging, and costumes.

YOU ARE ON THE JOB:

You are a nuclear technician. Nuclear technicians help to find the best way to use nuclear energy to provide usable goods and services to society. They use the principles of English grammar to convey their data in a meaningful way.

You work for Macay Engineering Consultants. You have received some raw data from a nuclear research specialist. The data concerns radionucleid travel time, the amount of time it takes for radioactive material to travel through land, air, or water.

The data has been collected for two dairy farmers, Mr. and Mrs. Devoe. They live near a nuclear reactor that has just been found to be leaking radio-iodine (151-iodine).

This material, formed during the process of nuclear fission, has escaped the reactor. The atmosphere is contaminated. With rainy weather, the gas condensed and also contaminated the grass—food for Mr. and Mrs. Devoe's cattle. As a result, the cows' milk is harmful and undrinkable. The Devoes want to know how long they will have to wait before they can safely sell their dairy products again.

You have analyzed the data. Your results show that four days should have been sufficient time to get rid of the contamination. The milk should now be safe for the Devoes and for the community.

Now you must write up the data and your analysis in report form. You will submit this report to Macay's Internal Review Board. It will then be presented to the Nuclear Safety Council and the local and national farm bureaus. They will make the final decision about the safety of the milk.

If you do not make sense of your data for the reviewers, they may misinterpret your results; the Devoes may start selling their dairy products too soon; they and their customers could suffer the effects of radiation. If they wait too long, the Devoes could waste the products on which they depend for a living.

Important features to consider include the following:

- listing the assumptions of your experiment
- organizing your data
- *explaining* your data versus presenting it. Reports must make sense of information.
- varying your sentence structure

Now you need to categorize your data and outline the report. Then write the report using sentences to *explain* the data.

DATA:

radionucleid travel time (151-iodine) = 24 hours to contaminate grass
+ 24 hours to contaminate cows' milk

maximum safe radiation allowed = .1 microcurie/liter (mc/l)

Day	Amount of radiation found in milk of one of Devoe's cows	Recommendation
1	.15 mc/l	Throw milk out.
2	.13 mc/l	Throw milk out.
3	.11 mc/l	Throw milk out.
4	.10 mc/l	Throw milk out.

INFORMATION ABOUT SENTENCES:

A sentence is a group of words that expresses a complete thought. This is also called an *independent clause* because it can stand alone. Every sentence contains two parts: a subject and a predicate. The *subject* is the part about which something is said. The *predicate* is the part that says something about the subject. A sentence begins with a capital letter and ends with a period.

Four different kinds of sentences exist; simple, compound, complex, and compound-complex. A *simple sentence* contains one independent clause. A *compound sentence* contains at least two independent clauses joined by a conjunction. A *complex sentence* contains at least one dependent clause (a clause that does not express a complete thought) and one independent clause. And a *compound-complex sentence* contains at least two independent and one dependent clause.

A *topic sentence* states the controlling idea of a paragraph; other sentences in the paragraph support the idea stated in the topic sentence.

Examples:

sentence	**not a sentence**
Airplanes landed on the runway.	landed on the runway or airplanes

Sentence types:

simple— The dog barked.	compound— The dog barked, and the cat leapt. .
complex— Although the cat ran away, the dog continued to bark.	compound— Because the cat was frightened, he ran away, and he did not come back for two days.

Topic sentence and support:

Suzanne planned a very active day. She would awake at 7:00. She would work from 8:00 a.m. - 5:00 p.m. and run from 5:30 - 6:30 p.m. Then, she would eat, and finally, she would go to bed.

HOW TO WRITE YOUR REPORT:

1. Title your report so that people will know the topic.

2. Write a topic sentence for each of the two categories provided:

   - amount of radiation
   - recommendations

3. Select relevant data to support your topic sentence in each paragraph. Remember to *not* just list your data. You must explain its meaning.

4. Write a concise introductory paragraph outlining your report. Note any assumptions and other information the readers should know before continuing (e.g., background).

5. Summarize your findings in a final paragraph.

6. Edit, combine, and order your report according to the following outline:

   - introductory paragraph
   - topic sentence about amount of radiation
   - explanation of data about amount of radiation
   - topic sentence about your recommendations
   - explanation of how the data supports your recommendations

7. Proofread grammar, spelling, punctuation, and data. The outcome for the plan of action that you recommend depends on your ability to communicate it effectively.

ONE POSSIBLE
SOLUTION:

Report on Level of Radio-iodine Found in Devoe's Cow's Milk

Radio-iodine (gas, 151-iodine) leaked from a nuclear reactor near the home of Mr. and Mrs. Peter Devoe. After a rain, the gas took approximately 24 hours to condense and contaminate the surrounding area. Radio-iodine could be detected in the milk of Devoe's cows 24 hours later. A specialist brought data about this matter to our consulting center for analysis and further suggestion. The assumption made is that the contamination found in one cow's milk is the same as that found in that of other cattle at Devoe's farm. I submit the following findings and recommendatins.

By the fourth day of testing, the radiation found in the cow's milk was within an acceptable standard of .10 microcurie per liter. On day one, .15 mc/l of 151-iodine contaminated the milk. By day four, this amount had significantly dropped to .10 mc/l. This decrease was most substantial at first, dropping .02 mc/l from day one to day two and then again .02 mc/l from day two to day three. The decrease from day three to day four was smaller (.02 mc/l). This suggests that the concentration of radiation in the milk is approaching its normal level.

Two specific forms of action are recommended to assure the safety of the Devoes and their customers. The first recommendation is to throw out the milk from the first four days. The second involves throwing portions of the milk into separate rivers to disperse the radiation. Thus, the hazard to all people involved should be minimized.

Based on the data provided above, particularly the present safe level of radiation in the cow's milk, Devoes should be advised to continue selling their dairy products. The contaminated milk of the past four days should be disposed of by the specialist.

Guidelines for Writing One Type of Student Activity in a Problem-Solving Mode

Example

I. Sections

A. Topic to Apply: the academic topic being used

B. How People Use (academic topic) On the Job: two examples of how others use the same academic topic in their work

1. Use occupations that relate to your vocational program
2. Use occupations that are not similar in type or in job level

C. You Are On the Job

1. Describe the occupation
2. Describe "your" position within the occupation
3. Describe the situation
4. Describe "your" part in the situation
5. Give a specific description of "your" problem
   a. Involve
      —decision making
      —analysis
      —problem solving
      —categorizing
      —calculating
      —setting priorities
   b. Plan for students to complete the problem in 20-30 minutes
   c. State what the outcome and the possible consequences will be

D. Information About (academic topic)

1. Review or present the basic subject matter that students need to solve the problem such as definitions, formulas, etc.
2. Give information that is relatively concept-oriented rather than occupation-oriented

E. How to (do) Your (task)

1. The Process
   a. Break down the problem and provide sequential directions for the solution process.
   b. Allow space to work out the solution, the amount of space depending on the concept/activity
   c. Give guidance in reaching the solution if the process is difficult or complex
2. The Product
   a. Provide for closure to the activity
   b. Tell the student what to do with the solution in concrete terms
   c. Explain the real consequences and why they are important

F. One Possible Solution

1. The Process
   a. Give the method when that leads to one correct solution
   b. Give a sample of a process that leads to one of several acceptable solutions (if that is suitable)
2. The Product: Show a completed product (for example, show entries on a form to be submitted to another department for further processing)

II. Characteristics

A. Consumable

B. Self-contained

C. No more than six pages long

D. Does not require out-of-class work

E. Does not require materials not normally found in the classroom for that subject

F. Is written at the 9th grade level and according to development guidelines

Appendix E

Quality Control Checklist

Quality Control Checklist

Example

A. **General Principles**

The quality control reviewer should focus on the following central objectives of module development:

- Explain the steps and procedures carefully so that the trainee understands what to do
- Provide clearly and simply for application of the procedures to give the trainee practice
- Render the entire module readable at an 8th-9th grade level

The general pattern of modules is to explain to the students how to do a procedure, show them how to do it, and—to the extent possible—prompt them to practice it on the forms and records in their Worksheet Package. It is important to:

- Provide explicit instructions
- Ensure that the practice exercise is consistent and complete
- Give an example of each desired outcome

Careful editing and proofreading of the module is essential. Grammatical, spelling, or typographical errors constitute learning obstacles for students. Quality control reviewers must be "picky" and perfectionistic.

B. **Component Parts of the Module**

Checklists are provided for each of the module components in turn.

1. **Task Title and Module Title**

_____ Is brief and to the point

_____ Summarizes all that is done in the task or module

_____ Begins with an imperative

_____ Contains only one verb

2. **Objective**

a. What will you do

_____ Provides a more detailed version of the task title

_____ Includes all operations in the task

_____ Includes underlining of form names

b. What you need

_____ Lists the contents of the Data Sheet Package, in the same order

_____ Has a hyphen preceding each item

_____ Omits underlining of form names

c. How well

_____ Tells the observable outcomes if the task is done correctly

_____ First sentence (only) begins with "So that"

_____ Includes underlining of form names

_____ Forms one flush line of typing

3. **Introduction**

_____ Tells the trainee what he/she will do (but does not restate the "What You Will Do" paragraph)

_____ Relates the action to the end-product of the task and how the end-product is used

_____ Explains the purpose of the task

_____ Relates the task to other tasks, if possible

_____ Explains the relationship of the module to others in a series

_____ Includes the "Turn to the CRT" paragraph

4. **Materials You Need**

_____ Lists supplies, such as paper and pen or pencil, needed to complete the module

_____ Lists under the heading "Worksheets" the contents of the Worksheet Package, in the same order

_____ Omits underlining of form names

5. **Words to Know**

_____ Includes only words listed in the glossary

_____ Lists words in alphabetical order

_____ Introduces the word list by a standard statement

5. **Body of the Module**

_____ Reflects the task analysis accurately, though possibly reorganized and/or resequenced for the proper alignment of component parts: operations, steps, and procedures

_____ Follows the structural number system as given:

1st digit—task number
2nd digit—operation number
3rd digit—step number
lower case letter—procedure

_____ For example, Step 45.1.1 indicates the forty-fifth task, first operation, first step.

_____ Is not unwieldy for students; i.e., not over 20-30 pages. (If a module needs to be split, the split should be made at the operation level with neither resulting module being shorter than 10 pages.)

_____ Is page-numbered independently of the introductory and CRT sections of the module

a. Operations

_____ Are collections of undeniably related steps

_____ Are stated as a title (with significant words initially capitalized and with no end punctuation)

_____ Are boxed

_____ Imply an outcome

b. Steps

_____ Direct the main actions the trainees must take to complete the operation

_____ May describe conditional actions, in which case the sentence begins with "if," for example, "If the totals do not agree, prepare a reconciliation worksheet."

_____ Are followed by "Here is how:" if they are divided into procedures

c. Procedures

_____ Take the "naive learner" through each step clearly, carefully, and gradually

_____ Provide for a logical flow

_____ Avoid gaps or assumptions requiring a cognitive leap by the trainees

_____ Give specifics and examples

_____ Direct only one action

_____ Are illustrated when the verbal message can be complemented by a graphic

_____ Provide a completed form as an example when necessary

_____ Present lists of data in tables

_____ Work from the general to the specific. (For example, refer to form, section of the form, column, line or space, and then the practice exercise reference.)

E. **Readability Considerations**

The developer:

_____ Writes in a direct conversational style

_____ Writes at the 8th-9th grade level according to the Gunning readability formula

_____ Writes short, single-topic paragraphs

_____ Uses short, simple, concrete, familiar words (e.g., "job," "use") rather than complex, unfamiliar ones (e.g., "occupation," "utilize")

_____ Makes directions as clear and explicit as possible

_____ Introduces new vocabulary terms gradually, one to a paragraph, rather than all at once. Using short and simple words, provides a clear and complete definition for each new term.

_____ Introduces only one variable or one concept at a time

_____ Uses active verbs; avoids the passive voice whenever possible

_____ Avoids compound sentences

_____ Avoids "there is," "there are" and "it is"

_____ Avoids connectives like "therefore" and "however"

_____ Omits unnecessary words

_____ Uses clear and grammatically correct pronoun referents

_____ Uses dependent clauses only if they are short and necessary

_____ Breaks up text by lists, tables, and other similar techniques whenever possible

_____ If an important word is difficult, places the difficult word in a context that is simple and clear

_____ Uses words consistently throughout the module

F. **Editorial/Format Considerations**

The developer:

_____ Underlines the titles and numbers of all forms where they appear in the text. Does not underline form titles in the task title or in the operation boxes.

_____ References specific Data Sheets and Worksheets to be used in the practice exercise as follows: (Data Sheet C) or (Worksheet 2).

_____ Uses lowercase letters for generic words, such as:

- employee
- time card
- paycheck

Example: Post the employee number to each time card.

_____ Uses an initial cap for names of all forms when they appear in the text, with the exception of forms that are usually referred to by generic title, such as a time card, a memo, an invoice, or a paycheck

_____ Writes all column, line, and space titles in ALL CAPS

References

Appleby, Judith A. *Conducting Task Analyses and Developing Instructional Objectives*, Module 8, Vocational Education Curriculum Specialist. Palo Alto, CA: American Institutes for Research in the Behavioral Sciences, 1981.

Alliance for Career and Vocational Education, *Curriculum Developer's Resource Guide*. Columbus, OH: The National Center for Research in Vocational Education, 1980.

Develop a Lesson Plan, Module B-4 of Performance-Based Teacher Education Modules. Columbus, OH; The National Center for Research in Vocational Education, 1979.

Dunn, James A.; Gray, Peter; and Martini, Elizabeth. *Teacher Guide: Teaching Basic Skills Through Vocational Education*. Ithaca, NY: Cornell Institute for Occupational Education, 1982.

Ericson, Arthur W., Greenwood L. Jane, and King, Donald E. *Beyond Equivalency*. Montpelier, VT: Adult and Vocational-Technical Education Division, Vermont State Department of Education, 1986.

Hindes, Thomas; Unpublished lesson plan; Instructional Materials Laboratory, The Ohio State University, 1986.

Migal, Clifford A., *Correlating Basic and Vocational Skills Instruction*. Unpublished presentation given in Raleigh, NC on February 21, 1985.

Miguel, Richard J., Editor; *Education and Employment: Where We Are and Where We Ought to Go, Annual Policy Forum Proceedings*. Columbus, OH: The National Center for Research in Vocational Education, 1985.

The National Commission on Secondary Vocational Education; *The Unfinished Agenda, The Role of Vocational Education in the High School*. Columbus, OH: The National Center for Research in Vocational Education, 1985.

Norton, Robert E., *DACUM Handbook*. Columbus, OH: The National Center for Research in Vocational Education, 1985.

Program Planning, Development, and Evaluation. Modules A1-A11 of Performance-Based Teacher Education Modules. Columbus, OH: The National Center for Research in Vocational Education, 1979.

Sticht, Thoms G. and Mikulecky, Larry. *Job-Related Basic Skills: Cases and Conclusions*. ERIC Clearinghouse on Adult, Career, and Vocational Education Information Series No. 285. Columbus, OH: The National Center for Research in Vocational Education, 1984.

Worsham, Antoinette, M. and Stockton, Anita J. *A Model for Teaching Thinking Skills: The Inclusion Process; Fastback 236*. Bloomington, IN: Phi Delta Kappa Educational Foundation, 1986.

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BILL AS LISTED BELOW
- ☐ Bill Me
- ☐ Bill My Agency/Organization on Purchase Order No. _____
  - ☐ Purchaseing Order Enclosed
  - ☐ Confirming P.O. to Follow

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- ☐ $_____ U.S. enclosed CK No. _____ (payable to the National Center for Research in Vocational Education)
- ☐ Payable on receipt of invoice

CHARGE* TO MY CREDIT CARD ☐ ☐

_____ Expiration Date _____
Credit Card Number mo. yr.

_____ $ _____ U.S.
Name on Card (Print or Type) Amount

_____ _____
Authorized Signature Date

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* Agreeing to pay the sum, set forth to the bank which issued the card in accordance with the terms of the credit card.

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Agency

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Name/Title

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City State Zip

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Agency

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_____
City State Zip

Order Authorized by _____
Signature Date

OFFICE USE ONLY Date _____

Authorization _____

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